

# STONE.

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The present report on stone in the United States is intended particularly to show the distribution by counties of the different varieties in the various productive States and Territories. With this purpose in view, each productive State and Territory is treated of by itself. The statistical figures apply in the large majority of cases to the calendar year 1889, and they serve to show the relative magnitudes of the industries. In addition to the subject of distribution, other features of interest in regard to the properties, the chemical constitution and physical structure of the stone and the purposes to which it is applied are included in so far as the data at hand at this time will permit.

In 1889 there were produced in the United States limestone, granite, sandstone, marble, slate, and bluestone, named in the order of their commercial importance.

The total value of this stone product, according to the results of the Eleventh Census, was \$53,035,620, distributed as follows: Limestone, \$19,095,179; granite, \$14,464,095; sandstone, \$10,816,057; marble, \$3,488,170; slate, \$3,482,513; and bluestone, \$1,689,606. In 1890 no such detailed canvass of the United States was attempted as was executed in the previous year for the Eleventh Census. Building was more active in 1890 than in 1889, and the total shows fully the normal growth to a total value for stone of all kinds of \$54,000,000.

## LIMESTONE.

*Production.*—The value of the limestone produced in the United States in 1889, as shown above, was \$19,095,179. It was produced in 40 States and Territories as follows:

*Production of limestone in the United States in 1889, by States and Territories.*

Rank.	States and Territories.	Value.	Rank.	States and Territories.	Value.
1	Pennsylvania.....	\$2,655,477	22	Connecticut.....	\$131,697
2	Illinois.....	2,190,607	23	New Jersey.....	129,662
3	Indiana.....	1,889,336	24	Massachusetts.....	119,978
4	Missouri.....	1,859,960	25	West Virginia.....	93,856
5	New York.....	1,708,830	26	Michigan.....	85,952
6	Maine.....	1,523,499	27	Tennessee.....	73,028
7	Ohio.....	1,514,934	28	Idaho.....	28,545
8	Wisconsin.....	813,963	29	Rhode Island.....	27,625
9	Minnesota.....	613,247	30	Utah.....	27,508
10	Iowa.....	530,863	31	Montana.....	24,964
11	California.....	516,780	32	Arkansas.....	18,360
12	Kansas.....	478,822	33	South Carolina.....	14,520
13	Alabama.....	324,814	34	New Mexico.....	3,862
14	Kentucky.....	303,314	35	Oregon.....	
15	Washington.....	231,287	36	Georgia.....	
16	Texas.....	217,835	37	Florida.....	77,935
17	Nebraska.....	207,619	38	Arizona.....	
18	Vermont.....	195,066	39	South Dakota.....	
19	Maryland.....	164,860	40	Wyoming.....	
20	Virginia.....	159,623			
21	Colorado.....	138,091		Total.....	19,095,179



*Uses.*—The principal purpose for which the limestone was used was for the production of lime, the value of the lime produced being \$8,217,015. For building purposes \$5,405,671 worth was used; for street work, \$2,383,456; for a flux in blast furnaces the limestone used was worth \$1,569,312; for bridge, dam, and railroad work, \$1,289,622, and for miscellaneous purposes \$230,103 worth was used.

#### GRANITE.

*Production.*—The value of the granite produced in the United States in 1889 was, as shown in the following statement, \$14,464,095. This product was distributed among twenty-eight States and Territories, as follows:

*Production of granite in the United States in 1889, by States and Territories.*

Rank.	States.	Value of output.	Rank.	States.	Value of output.
1	Massachusetts.....	\$2,503,503	16	South Dakota.....	\$304,673
2	Maine.....	2,225,839	17	Wisconsin.....	266,095
3	California.....	1,329,018	18	New York.....	222,773
4	Connecticut.....	1,061,202	19	Delaware.....	211,194
5	Rhode Island.....	931,216	20	North Carolina.....	146,627
6	Georgia.....	752,481	21	South Carolina.....	47,614
7	New Hampshire.....	727,531	22	Oregon.....	44,150
8	Pennsylvania.....	623,252	23	Texas.....	22,550
9	Vermont.....	591,870	24	Utah.....	8,700
10	Missouri.....	500,642	25	Montana.....	76,000
11	Maryland.....	447,489	26	Arkansas.....	
12	New Jersey.....	425,673	27	Washington.....	
13	Minnesota.....	356,782	28	Nevada.....	
14	Virginia.....	332,548			
15	Colorado.....	314,673		Total.....	14,464,095

*Uses.*—The purposes to which the granite product was put were as follows: Building, \$6,166,034; street work, \$4,456,891; cemetery, monumental, and decorative purposes, \$2,371,911; bridge, dam, and railroad work, \$1,238,401, and miscellaneous uses, including millstones, walls (fences) watering troughs, posts, engine and machine beds, yard stock, boundary stone, horse blocks, etc., \$230,858.

#### SANDSTONE.

*Production.*—The total value of the sandstone produced in the United States in 1889 was \$10,816,057. The States contributing to this total were, in the order of output, as follows:

*Production of sandstone in the United States in 1889, by States and Territories.*

Rank.	States and Territories.	Value of output.	Rank.	States and Territories.	Value of output.
1	Ohio.....	\$3,046,656	22	Alabama.....	\$43,965
2	Pennsylvania.....	1,609,159	23	Montana.....	31,648
3	Colorado.....	1,224,098	24	Arkansas.....	25,074
4	Connecticut.....	920,061	25	Illinois.....	17,896
5	New York.....	702,419	26	Wyoming.....	16,769
6	Massachusetts.....	649,097	27	Texas.....	14,651
7	New Jersey.....	597,309	28	North Carolina.....	12,000
8	Michigan.....	246,570	29	Virginia.....	11,500
9	New Mexico.....	186,804	30	Maryland.....	10,605
10	Wisconsin.....	183,958	31	Arizona.....	9,146
11	California.....	175,598	32	Oregon.....	8,424
12	Missouri.....	155,557	33	New Hampshire.....	3,750
13	Kansas.....	149,289	34	Tennessee.....	2,722
14	West Virginia.....	140,687	35	Idaho.....	2,490
15	Minnesota.....	131,979	36	Rhode Island.....	26,199
16	Kentucky.....	117,940	37	Nevada.....	
17	South Dakota.....	93,570	38	Vermont.....	
18	Iowa.....	80,251	39	Florida.....	
19	Washington.....	75,936	40	Georgia.....	
20	Utah.....	48,306			
21	Indiana.....	43,983		Total.....	10,816,057



*Uses.*—The principal use to which the sandstone product of 1889 was put was for building, \$7,121,942 worth, or over 65 per cent of the product being devoted to this purpose; for street work, a quantity valued at \$1,832,822 was used, while bridge, dam, and railroad work consumed \$1,021,920 worth of the product. For abrasive purposes \$580,229 worth was used, and for miscellaneous uses, \$259,144. The last classification includes the stone used for grout, hitching-posts, fence walls, sand for glass, sand for plaster and cement, furnace hearths, lining for blast furnaces, rolling-mill furnaces, adamantine plaster, millstones, cemetery work, watering troughs, fluxing, ganister, firebrick, silica brick, lining for steel converters, glass furnaces, core sand for foundries, and random stock.

## MARBLE.

*Production.*—The value of the marble produced in the United States in 1889 was \$3,488,170. This was the product of ten States, as follows:

*Production of marble in the United States in 1889, by States.*

Rank.	States.	Value of output.	Rank.	States.	Value of output.
1	Vermont.....	\$2,169,560	7	Pennsylvania.....	\$121,850
2	Tennessee.....	419,467	8	Massachusetts.....	
3	New York.....	354,197	9	Idaho.....	
4	Georgia.....	196,250	10	Virginia.....	
5	Maryland.....	139,816			
6	California.....	87,030		Total.....	3,488,170

*Marble imported and entered for consumption in the United States, 1867 to 1883, inclusive.*

Fiscal years ending June 30—	Sawed, dressed, etc., not over 2 inches in thickness.	Sawed, dressed, etc., over 2 and not over 3 inches in thickness.	Sawed, dressed, etc., over 3 and not over 4 inches in thickness.	Sawed, dressed, etc., over 4 and not over 5 inches in thickness.	Sawed, dressed, etc., over 5 and not over 6 inches in thickness.	Veined and all other, in blocks, etc.	White, statuary, brocatella, etc.	Not otherwise specified.	Total.
1867.....						\$192,514	\$2,540	\$51,978	\$247,032
1868.....						309,750	4,403	85,783	399,936
1869.....						359,881	3,898	101,309	465,088
1870.....						332,839	3,713	142,785	479,337
1871.....	\$5,973	\$168	\$77	\$44	\$28	400,158	1,134	118,016	525,598
1872.....	3,499	1,081	452		318	475,718	4,017	54,539	539,624
1873.....	3,124	21				396,671	4,148	69,991	473,955
1874.....	1,837					474,680	2,863	51,699	531,079
1875.....	1,450	427	96			527,628	1,623	72,389	603,619
1876.....	595	126	203	87		529,125	1,151	60,596	591,884
1877.....	2,124					349,590	1,404	77,293	430,411
1878.....	198	11	8			376,936	592	43,915	421,660
1879.....	184					329,155	427	54,857	384,623
1880.....						531,908	7,239	62,715	601,862
1881.....	339					470,047	1,468	82,046	553,900
1882.....	655					486,331	3,582	84,577	575,145
1883.....	619					533,096	2,011	71,905	607,631



During the calendar years ending December 31, from 1886 to 1890, and fiscal years ending June 30, for 1884 and 1885, the classification has been as follows:

*Marble imported and entered for consumption in the United States from 1884 to 1890.*

Classification.	1884.	1885.	1886.	1887.	1888.	1889.	1890.
In block, rough or squared, of all kinds .....	\$511,287	\$429,186	\$408,895	\$355,648	\$357,220	\$498,275	\$510,354
Veined marble, sawed, dressed, or otherwise, including marble slabs and marble paving tiles ..	12,941	43,923	96,625	142,405	107,957	115,909	142,653
All manufactures of, not specially enumerated .....	67,829	54,772	44,053	31,880	69,086	61,231	132,376
Total .....	592,057	527,881	549,573	529,933	534,263	675,415	785,383

#### SLATE.

*Production.*—Slate valued at a total of \$3,482,513 was produced in the United States during 1889. Twelve States contributed to this product as follows:

*Production of slate in the United States in 1889, by States.*

Rank.	States.	Value of output.
1	Pennsylvania .....	\$2,011,726
2	Vermont .....	842,013
3	Maine .....	219,500
4	New York .....	126,603
5	Virginia .....	113,079
6	Maryland .....	110,008
7	California .....	18,089
8	Georgia .....	15,330
9	New Jersey .....	10,925
10	Michigan .....	} 15,240
11	Arkansas .....	
12	Utah .....	
	Total .....	2,482,513

*Uses.*—By far the greater portion of the slate produced in this country is used for roofing purposes, the value of the slate thus used in 1889 being \$2,797,904, while that devoted to other purposes was valued at \$684,609.

#### BLUESTONE.

*Production.*—This variety of sandstone was produced in only three States, the total value of the product being \$1,689,606, divided as follows:

*Production of bluestone in the United States in 1889, by States.*

Rank.	States.	Value of output.
1	New York .....	\$1,303,321
2	Pennsylvania .....	377,735
3	New Jersey .....	8,550
	Total .....	1,689,606



*Uses.*—Originally bluestone was used for flagging only, to which purpose the larger portion is still applied, but the use of it has extended to other purposes, such as rubble masonry, retaining walls and bridge stone, sidewalks, curbing, gutters, stepstones, flooring, vault covers, bases of tombstones, porch and hitching posts, and house trimmings.

## ALABAMA.

The kinds of stone produced in this State are, in the order of their commercial importance, limestone and sandstone.

*Limestone.*—This comes from twenty-one quarries, distributed over the following counties: Shelby, \$87,540; Colbert, \$69,494; Lee, \$52,500; Blount, \$42,000; Franklin, \$28,586; De Kalb, \$16,333; Etowah, \$13,567; Jefferson, \$10,000, and smaller amounts in Jackson and Talladega counties. The value of the entire product as sold, including the value of the lime made from it, was \$324,814. Of this amount the value of lime produced was \$178,248. Other uses to which the stone is put are, in order of importance, blast-furnace flux, building, and street work.

*Analysis of limestone from Chewacla, Lee county.*

	Per cent.
Calcium carbonate .....	57.73
Magnesium carbonate .....	41.58
Ferric oxide and alumina .....	.12
Siliceous matter .....	.89
Total .....	100.32

*Sandstone.*—The amount produced in 1889 was valued at \$43,965. The stone comes mainly from Jefferson county, with a product of \$28,500, and small amounts from Colbert and St. Clair counties. It is used principally in the erection of buildings, a small quantity being devoted to bridge, dam, and railroad work.

*New and prospective developments.*—Marble has been found near Florence, Lauderdale county, 1 mile from the Louisville and Nashville railroad, and it is possible that developments may be made at this point. The Shelby Lime and Cement Company opened a new limestone quarry in February, 1890. The Cherokee Stone and Railroad Company opened a sandstone quarry in Colbert county in the fall of the same year.



## ARIZONA.

Sandstone and limestone in small quantity are produced, the former in Maricopa and Yavapai counties and the latter in Gila county. The product is used locally.

*New and prospective developments.*—Messrs. Murphy and Austin, of Prescott, operated to a limited extent quarries of brown and lilac sandstone in 1890. The completion of prospective railroad facilities will increase their operations.

## ARKANSAS.

The kinds of stone produced in this State are, sandstone, \$25,074; limestone, \$18,360; granite and slate in small amounts.

*Sandstone.*—The counties producing sandstone are, in the order of their importance, Johnson, Sebastian, Conway, and Miller. The product is used mainly for building purposes, although some is devoted to street and railroad work.

*Limestone.*—Limestone comes from Independence, Benton, Washington, and Carroll counties, and is used chiefly for burning into lime.

*Granite.*—The production of this stone is limited to Pulaski and Saline counties, and has extended over only a few years; but the outlook for larger operations in the future is good. The granites of Arkansas, which are, exactly speaking, syenites, are known as the Fourche Mountain or Little Rock, the Saline county and the Magnet Cove syenites. The first of these groups forms the Fourche mountain, a few miles south of Little Rock, and contains the so-called blue granite, which is an elæolitic augite hornblende syenite, and some gray granite, which is a light-gray cross-grained elæolite syenite. The blue granite has already become a very important building stone, and it is also used in the manufacture of paving blocks. The gray granite has been produced to a small extent. The Saline County region contains almost exclusively elæolite syenite of a reddish or grayish color, which has found little or no market on account of its distance from the railroad. The rock of the third region is worked to some small extent in building railroad culverts and foundations of houses. The following tests were made in the mechanical laboratory at the Rensselaer Polytechnic Institute at Troy, New York, on a 50,000-pound Tinois-Olsen testing machine. The specimens were cubical in form and were cushioned with pieces of book-binders' board about three-sixteenths of an inch in thickness. They broke suddenly with an explosive force and in some cases the small fragments tore the heavy binders' board completely to pieces. In regard to the stone from Fourche mountain, it may be said that it is easily quarried, occurring in long ridges 200 to 300 feet in height, and by opening a quarry on the side of any one of these easy access to the stone is obtained, and perfect drainage and a convenient dump may be had at a minimum of cost.



*Results of tests of Arkansas syenites.*

Number.	Description of specimens.	County where found.	Area of surface.	Actual crushing load.	Pressure per square inch.	Reduced to correspond to pressure per square inch in two-inch cubes.	Ratio of absorption—1 to —	Specific gravity at 60° F.
			<i>Sq. in.</i>	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>		
1	Light colored elaeolite syenite, slightly decomposed .....	Saline ..	2.34	48,000	20,500	22,350	761	2.62
2	"Gray granite," a very light-colored elaeolite syenite .....	Pulaski.	2.25	33,750	14,000	16,000	83	2.45
3	Brownish elaeolite porphyry, occurs in narrow dikes .....	do ..	1.42	30,000	21,000	24,980	161	2.52
4	"Light-blue granite" (syenite) .....	do ..	1.64	47,000	28,700	33,280		
5	"Light-blue granite" (syenite), somewhat darker .....	do ..	1.07	22,800	21,500	26,820		
6	"Light-blue granite" (syenite), still darker .....	do ..	1.57	35,950	22,900	26,745	1,673	2.64
7	"Medium blue granite" (syenite) .....	do ..	1.50	43,500	29,000	34,150		
8	"Dark blue granite" (syenite porphyry) .....	do ..	1.57	43,800	27,900	32,630	4,530	2.69
	Mean of last five specimens.							
	Average for "blue granite" .....	do ..			26,000	30,740		

*Slata.*—A small quantity was quarried in Pulaski county in 1889. There is good reason to anticipate an increased production in the future.

*New and prospective developments.*—Variegated marble is found in Marion county, and Mr. L. Matlock, of Yelville, opened a quarry of it in the summer of 1890. A large area of marble outcroppings has been traced out and mapped in the region north of the Boston mountains in this State. These marbles are susceptible of a high polish and are of several shades of red, pink, and variegated. They are said to compare favorably with the Tennessee marble, but investigations and developments have not yet proceeded to a point which justifies more definite statements as to the future. The American Onyx Company, of Kansas City, Missouri, opened a marble quarry in Benton county in the summer of 1890.

In northern Arkansas, according to the Geological Survey at present being conducted under the direction of Mr. John C. Branner, State geologist, there are six distinct beds of limestone. Each of these six beds will furnish good building material. The upper bed in places will furnish marble, although the greater part of it has little commercial value. The third bed in the series furnishes an excellent building stone at almost every outcrop, and it is found throughout nearly all the northern counties. It corresponds quite closely with the Indiana oölitic limestone, being in the same geological horizon and resembling it in structure, except that it is more crystalline and takes a finer polish than the Bedford, Indiana, stone. It is more crystalline, less oölitic, and more fossiliferous in the western than in the eastern part of the bed. It has been quarried at Batesville, Independence county, for building stone and burning into lime. The fourth bed in the series, belonging to the Trenton period, occupies the same geological position



as the Tennessee marble, which it resembles in structure and appearance. It has been traced and carefully mapped through Independence, Izard, Stone, Searcy, Marion, and parts of Newton and Boone counties. It is known to exist also in Madison and Carroll counties, and possibly extends as far west as the State line or beyond. Small quantities only have been quarried for local use in monuments and mantels. It varies in color through light gray, pink, red, variegated, and mottled. The fifth bed is found in great quantities in Independence, Izard, Stone, and Searcy counties. It is a fair building material and burns to produce good lime. Some lithographic stone has been obtained from it.

#### CALIFORNIA.

Until within a comparatively few years the demand for stone in this State has not been very great, and consequently the development and growth of the California industry is by no means in proportion to the resources in stone of all kinds which the State has revealed and which have been recognized and known for a long time. Most of the buildings of the State have been of pine or redwood, the abundance, accessibility, and cheapness of which have caused their general adoption. The mild climate has also tended to retard the adoption of the more substantial stone in the erection of dwellings. Insufficient facilities for transportation have naturally also been an obstacle in the way of quarry development, and in some localities where fine stone is abundant and accessible this drawback will be felt for years to come.

Even where the demand for stone becomes as great in comparison with other building materials as could possibly be expected, the number of large cities in California and neighboring States is insufficient to offer inducements for the development of more than a small fraction of the valuable quarry property known to exist, and shipments to remote points will have to be made before production will be commensurate with the possibilities. Such shipments are, however, by no means out of the question in view of the fact that a larger amount of eastern stone is shipped to California than would ordinarily be suspected. This is notably the case with slate, and to some extent also with other kinds of stone produced at eastern quarrying centers. This State produces the following kinds of stone, named in the order of their commercial importance: Granite, limestone, marble, and slate.

*Granite.*—This comes from 76 quarries in the following counties, named according to the value of output: Placer, Sacramento, Sonoma, Alameda, Fresno, San Bernardino, Solano, Humboldt, San Diego, Tulare, Nevada, Los Angeles, Marin, and Calaveras. It is thus evident that granite is quarried at points scattered over an area extending from the extreme northern to the extreme southern part of the State. The great bulk of the product comes, however, from the first five counties, four of which are near Sacramento and San Francisco. The total output for the State in 1889 was valued at \$1,329,018. Of this



amount Placer county produced \$299,000 worth; Sacramento, \$289,000; Sonoma, \$215,000; Alameda, \$142,000, and Fresno, \$120,000. Somewhat less than half of the output is used for street paving and a slightly smaller quantity for ordinary building purposes. The granite quarries in the southern part of the State, while capable of producing large quantities of good stone, depend for their demand upon the southern portion of the State, and consequently the production will be necessarily limited until a wider territory of consumption is made available by a decided cheapening in transportation. In Fresno county are recently opened granite quarries 21 miles north of Berendo. Large developments are promised, the stone being so situated as to be accessible and easily handled. It is not regarded as a monumental stone, but it does not stain and answers very well for building. Large quantities of fine granite are to be found at Declezeville, Victor and Riverside in San Bernardino county; and at Temecula in San Diego county. In Placer county, Rocklin and Lincoln are the most important producing centers. The stone from these quarries takes a brilliant and lasting polish and is quite popular with builders. Quarries have been operated for about twenty years at Rocklin, Lincoln, Loomis, and Penryn. The Central Pacific railroad takes about 90 per cent. of the product to San Francisco. At Penryn the latest improvements for finishing and polishing granite are to be found in more complete condition than at any other locality in the State.

The Folsom quarries of Sacramento county are at a point 1 mile above the town of Folsom City, which is 20 miles from Sacramento. Stone from these quarries has been used in the construction of the stone viaduct at Mare Island navy-yard, and also at the State capitol in Sacramento. It also enters largely into the stone buildings in San Francisco. These quarries lie for 2 miles on both sides of the American river. In this vicinity one of the prisons of the State is located. A large dam constructed of granite across the American river was completed in December, 1890. The labor was for the most part convict labor furnished by the State. This great work was commenced in 1866, but for a complication of reasons was somewhat delayed until 1888, when it was reundertaken and pushed with vigor. Most of the granite recently quarried has been used in the construction of this dam and also of the canal. The enormous water power which this dam will render available will be used in the prison and also in the city of Sacramento, where it is expected an important industrial era will be inaugurated by the utilization of power from this source. The dam and canal are the most substantial structures of the kind on the Pacific coast. It is the intention of the Granite Company operating at this point to put large quantities of stone upon the market as soon as the canal and dam operations are entirely completed.

The granite-quarrying operations of Sonoma county are practically limited to the production of basalt paving blocks, which has for years constituted an important industry in this county.



*New and prospective developments.*—During 1890 new granite quarries were opened by Mr. Matthew Lumber, of Rocklin. The Western Granite and Marble Company, of San José, the Carlow Brothers, of Sacramento, and the California Improvement Company, of Oakland, are all engaged in new developments of quarry property.

*Sandstone.*—In 1889 sandstone was produced to the value of \$175,598 from fifteen quarries scattered over the following counties, named in order of output: Santa Clara, Amador, Ventura, San Bernardino, Yolo, Solano, and Napa. Of the total output Santa Clara yielded \$100,000 worth; Amador county was second, with a product valued at \$35,000. At San José a sandstone of light color and good quality is quite extensively quarried. It has been adopted upon the basis of its merits and its accessibility for use in the construction of the Stanford University. The Sespe Mountain sandstone of Ventura county is claimed to be the finest sandstone in the State, particularly for ornamental building.

*Marble.*—Four quarries in San Bernardino, Amador, Inyo, and San Louis Obispo counties produced in 1889, \$87,030 worth of marble. Of the total output San Bernardino produced to the value of \$78,000, by far the most of the entire product. It is thus evident that Southern California yields the bulk of the marble output of the State. The marble industry of California is in its infancy. The most advanced development is found in the quarries at Colton, San Bernardino county. Equipment for sawing, dressing, and polishing has just been completed. The stone is not what could be called strictly first class, but occasionally fine blocks are quarried. The quarries are so situated as to render operations easy and inexpensive. The developments in Inyo county are watched with interest. Shipments are steadily being made, and it is expected that railroad communication with Mojave will be made before long. Considerable prejudice among California marble workers against the marble of the State has had to be overcome, but, in view of the fact that the best quality of stone is not usually obtained near the surface, such unfavorable impressions are natural, but not always fair. Time must elapse before the stone can be fairly judged.

*New and prospective developments.*—The stockholders of the Carrara Marble Company in Amador county have been prospecting for a new railroad to their quarry. The marble from this quarry is regarded by certain experts in the State as the best to be found on the Pacific coast.

*Slate.*—Eighteen thousand dollars' worth of slate was produced from three quarries in El Dorado county in 1889. The product was used for quite a variety of purposes and appears to give entire satisfaction to the consumers. The demand for slate has been such in the past as to cause its importation from the East; the industry which has been opened up in the State ought therefore to thrive, and from present appearances it will grow steadily. At the Chili Bar slate quarry abundant water power is available, and while at present a large amount of dead work in stripping, etc., is to be done, the outlook for liberal production in the course of a year is exceedingly good.



*Limestone.*—Twenty-two quarries, scattered over eight counties in the State, produced limestone valued at a total of \$516,780. Of this amount \$513,130 represents the value of lime manufactured, so that it appears that only a small quantity of the total limestone production of the State goes for anything else than lime. The productive counties, named in order of value of output, are as follows: Santa Cruz, \$266,650; San Bernardino, \$74,000; Kern, \$47,630; San Benito, \$37,500; and smaller amounts in El Dorado, Santa Clara, San Diego, and Placer. The first-named county has for years been the principal producer of lime. Wood is abundant, cheap, and to be had immediately at the quarries. Transportation to San Francisco is by water. These advantages will probably enable Santa Clara county to maintain the lead for years to come. The most improved appliances are in use, and the lime is undoubtedly the best in the State. In San Benito county active operations have been inaugurated and the stone is of good quality. The following analyses of the limestone in this county have been made:

*Analyses of limestone from San Benito county, California.*

	Per cent.	Per cent.	Per cent.
Carbonate of calcium .....	96.00	99.2	99.0
Silica .....	2.10	.7	.5
Gypsum .....	Trace.	Trace.	Trace.
Total.....	98.10	99.9	99.5

The lime produced has to be hauled by twelve-horse teams to the railroad, thus adding to the cost of the lime; but it is said that this increase to the cost is largely offset by the ease of quarrying.

#### COLORADO.

The stone interests of Colorado have within a comparatively few years increased to very surprising proportions. The kinds of stone now produced are granite, limestone, and sandstone. The value of the stone output of this State in 1880 was only \$50,400. The kinds of stone produced were sandstone and granite, the granite being valued at \$41,400, while the value of the sandstone was only \$9,000. The value of the stone output of Colorado in 1889 was \$1,676,862. The developments are mainly due to the very much improved transportation facilities. The resources of this State are still undeveloped, and in almost all the varieties of stone produced for commercial purposes are very great.

*Granite.*—Ten quarries produced in 1889 an output valued at \$314,673. This came from six counties of the State, named as follows, in order of value of output: Douglas, \$200,049; Clear Creek, \$75,000; Gunnison, \$25,000; and much smaller amounts from Chaffee, Larimer, and Boulder counties. The great bulk of the product was used for general building



purposes, a smaller amount being devoted to monumental and cemetery use, and a trifling quantity to street work. The counties producing granite are all in the central part of the State, running from the extreme northern limits to about half the distance to the southern boundary. The greater portion comes from counties in the neighborhood of Denver.

*Sandstone.*—In 1889 there were seventy-one quarries producing sandstone, the product of which was valued at a total of \$1,224,098. The product came from the following counties, named in the order of their outputs: Boulder, \$405,773; El Paso, \$377,800; Larimer, \$317,388; Eagle, \$60,000; Jefferson, \$41,496; and smaller quantities from Las Animas, Fremont, Park, Huerfano, and Montezuma. An amount valued at \$703,477 was devoted to general building purposes. For street work the product used was valued at \$509,955; the remainder was devoted to bridge, dam, and railroad work. The enormous strides made in the production of sandstone are largely due to the operations of the Union Pacific Railroad Company. This company not only quarried sandstone, but by the transportation facilities furnished to other quarries brought the industry to its present stage of advancement. Colorado sandstone is now being shipped to remote points and is becoming well known to the general trade.

The following is an analysis of sandstone from a quarry in Boulder county:

*Analysis of Boulder county, Colorado, sandstone.*

	Per cent.
Silica.....	95.37
Oxide of iron.....	2.40
Lime.....	.92
Magnesia.....	.50
Loss by ignition.....	.55
Total.....	99.74

Among the most important sandstones of the State may be especially mentioned that known as Peachblow. This stone has met with very favorable reception and appears to be of good quality and color. It has been well received in Chicago.

*New and prospective developments.*—The following firms opened new sandstone quarries in 1890: Messrs. Kirk, Cramer and Davis, of Breckenridge, Mr. William Coates, of Walsenburg, and Mr. C. S. Faurot, of Boulder.

*Limestone.*—The total value of the limestone output of 1889 was \$138,091. Fifteen quarries were productive. The product came from the following counties: Jefferson, \$54,950; Boulder, \$36,500; Pitkin, \$24,127, and smaller amounts from Fremont, Pueblo, La Plata, and Larimer counties. The value of the lime produced in this State is \$91,101. For flux the amount used was valued at \$35,940. The balance was used for building purposes mainly.



*Marble.*—Although marble has not actually been quarried for market, the prospect for the development of this industry in the near future seems to be very good. Large masses of pure white marble are to be found on Whitehouse mountain near Marble city. Preliminary steps toward development have been taken. Gunnison county also contains marble deposits varying in color from pure white to jet black. Efforts are being made to secure the investment of capital for development. The marble deposits in Pleasant valley, northwest of Fort Collins, are of great interest, and some slight work of development has been attempted. The colors found at this place are red and pearl. This marble property is about 4 miles from the railroad and is easily accessible by an extension of the road.

## CONNECTICUT.

This State produced granite, sandstone, and limestone in 1889.

*Granite.*—The granite output of Connecticut was valued at \$1,061,202.

It came from the following counties: New Haven, \$421,246; New London, \$313,508; Fairfield, \$188,697; Litchfield, \$60,425; Middlesex, \$35,341; Windham, \$26,968, and smaller amounts from Hartford and Tolland counties. The product was used for the most part for building purposes. The amount devoted to this purpose was valued at \$758,915; for street work, including the value of all paving blocks, \$109,261; for cemetery and ornamental work an amount valued at \$111,155 was produced. For bridge purposes, \$65,659, and a much smaller amount for miscellaneous uses was produced. Granite is produced in every county in the State. The most important, however, are those along the Sound coast.

*Sandstone.*—The total value of the Connecticut sandstone produced in 1889 was \$920,061. By far the most of it came from the long known and celebrated brownstone quarries of Middlesex county. The counties in the order of the value of the product were: Middlesex, \$871,476; New Haven, \$40,495, and very much smaller amounts from New London and Hartford counties. The most important quarries are in the neighborhood of Cromwell and Middletown. The work is carried on on a large scale with the use of channeling machines. Some of the quarries have gone to a considerable depth. This stone has been extensively used in the largest cities of the East for many years, and it is so well known that it is unnecessary to touch upon the subject here at any great length. The principal quarries are at Portland and Middletown, on the east bank of the Connecticut river, in Middlesex county.

*Limestone.*—The value of the limestone output, including the value of lime made from it, produced in this State in 1889 is \$131,697. It came from Litchfield and Fairfield counties, the amounts from each being respectively \$87,342 and \$44,355. By far the most of the product was burned into lime, the value of the lime being \$129,663.

The following is an analysis of limestone from the Danbury Lime Company, whose quarry is in Fairfield county:



*Analysis of limestone from Fairfield county, Connecticut.*

	Per cent.
Lime .....	90.00
Silica .....	5.83
Alumina .....	3.90
Magnesia .....	.22
Total.....	99.95

*New and prospective developments.*—A new granite quarry was opened in 1890 by Mr. Patrick Garvey, of Bridgeport. The Totoket Granite Company, of New York City, began putting in a plant at the quarries at Stone creek in 1890. The quarries are not yet fairly in operation.

**DELAWARE.**

Granite to the value of \$211,194 was taken from five quarries in New Castle county in the northeastern part of the State. An amount valued at \$110,849 was devoted to bridge, dam, and railroad work, \$67,202 in street work, and \$32,443 for general building purposes.

**FLORIDA.**

Such a thing as the production of stone in this State has apparently been unheard of until careful investigation during the recent census developed the fact that Alachua county produced a small quantity of limestone for making jetties at the mouth of the St. Johns river. This stone is of course not the well-known coquina which has been used as a building material in this State in times long past.

Sandstone, flint, and limestone are reported as existing on the property of Mr. Louis Miller, of Sparr, Marion county. The sandstone has been quarried for local use.

**GEORGIA.**

Within the past few years the stone interests of this State have developed to a marked extent. The kinds of stone produced in 1889 were granite, sandstone, limestone, marble, and slate.

*Granite.*—Of these kinds, in point of value, granite was by far the most valuable, and it is interesting to know in this connection that while Georgia held twelfth place among the granite-producing States at the census of 1880 with a production of only \$64,480 worth of granite, at the Eleventh Census it takes sixth place with a production of more than ten times as much, namely, \$752,481 worth. This production in 1889 puts this State one place above New Hampshire, which has received the name of the "Granite State." The five States which produced more granite than Georgia in 1889 are: Massachusetts, Maine, California, Connecticut, and Rhode Island, in the order named. The granite-producing counties in the order of their importance are as fol-



lows: DeKalb, \$606,075; Hancock, \$68,083; Henry, \$57,950, and very much smaller amounts in Bibb, Elbert, Spalding, Rockdale, Jones, Oglethorpe, and Newton. Of the total product in 1889, \$347,100 worth went for building purposes and over \$250,000 worth for street work. Smaller amounts were used for cemetery and bridge and railroad purposes. Among the most important granite quarries in the State may be mentioned those conducting operations at Lithonia and Stone Mount. At these places the granite is quarried with great ease, Stone mountain being simply an uninterrupted and solid mass of granite almost entirely devoid of soil. The granite is loosened by blasting and then split by hand drills and wedges. The cheapness of unskilled labor, which is contributed entirely by negroes, together with the ease of quarrying, make it possible for operators to compete favorably with other granite-producing centers. The granite from Lithonia and Stone mountain has been quite thoroughly tested and examined by scientific authorities of high repute. The results of these examinations are very favorable to the stone.

*Marble.*—The value of the marble produced in Georgia in 1889 was \$196,250. Of this amount, \$10,000 worth came from Cherokee county, and of the remainder by far the most of the product came from Pickens county. The developments of Georgia marble have all been made within the past six years.

The following is an analysis of Pickens county marble made by Mr. John C. Jackson, of Chicago:

*Analysis of Pickens county, Georgia, marble.*

	Per cent.
Calcium carbonate .....	97.32
Magnesium carbonate.....	1.60
Silica.....	.62
Iron protoxide .....	.26
Alumina .....	.25
Total.....	100.05

It finds its chief application in wainscoting, mantels, table tops, counters, panels, etc.—in other words for purposes of interior decoration. The Georgia Marble Company has a very fine plant, and the shipping facilities are about all that could be wished. A very decided demand for this marble in most of the large cities of the Union has arisen, and seems likely to increase markedly from year to year.

*New and prospective developments.*—Deposits of marble have been known to exist in Whitfield county. Capt. Charles C. Davis, of Chattanooga, Tennessee, has recently purchased 160 acres of quarry land, and it is his intention to open quarries at once. The United States Marble Company has recently been incorporated to develop marble quarries in the State. The capital stock of this company is \$250,000.



*Slate.*—At the slate quarries at Rock Mart, Polk county, \$15,330 worth of stone was produced in 1889. These slate quarries have been operated for twenty-five years. Up to 1883, the slate was all hauled a distance of 23 miles by wagon, and yet was sold at a profit. In 1883 the East Tennessee, Virginia, and Georgia railroad was completed, and in 1885 the East and West Alabama railway, so that transportation facilities are now exceedingly good. The slate deposits are estimated to cover an area of about 360 acres and near the junction of the two railroads above mentioned. From all that can be learned of these quarries, the investment of a larger amount of capital could be made to pay well. In 1889, a determined effort was made to secure the investment of about a quarter of a million in the slate deposits as well as marble deposits which exist in the neighborhood of Rock Mart. The methods of quarrying and manufacturing have hitherto been of the very crudest nature, and the introduction of more improved methods would doubtless result in a very decided cheapening of the cost per square of roofing slate.

*Limestone.*—From Catoosa county was produced limestone to the value of \$24,656 in 1889; lime valued at \$20,000 was produced, and the remainder was used for furnace flux.

*Sandstone.*—A small amount of sandstone was produced in Randolph county, but the amount was almost insignificant.

#### IDAHO.

The stone industry in Idaho amounts to comparatively very little at present. The chief product is limestone, which in 1889 was valued at \$28,545, and came from three quarries in Kootenai, Bingham, and Alturas counties. Nearly the whole amount came from the first-named county and was entirely used for burning into lime. The lime is used entirely in neighboring towns.

*Sandstone.*—A small quantity of sandstone was produced in Ada county and was entirely used for building. The amount was insignificant.

*Marble.*—At Spring Basin, in Cassia county, marble was produced in sufficient quantities to supply local demands. The product is suitable for cemetery work, but it has never entered the market in competition with the well-known marbles of other regions.

#### ILLINOIS.

Limestone and sandstone have been produced in this State for some years. The latter, however, is of very small importance compared with the former.

*Limestone.*—The limestone produced in 1889 was valued at \$2,190,607. This product was obtained from 104 quarries, operated in the following counties, named in the order of the value of output: Cook, \$825,800; Will, \$742,177; Adams, \$91,000; Jersey, \$73,000; Madison, \$63,000;



Hardin, \$58,000; Kane, \$47,000; Pike, \$42,000; Kankakee, \$38,000; Hancock, \$35,000; Saint Clair, \$32,000; Winnebago, \$26,000; Rock Island, \$23,000; Henderson, \$22,000; Du Page, \$22,000; Randolph, \$16,000, and smaller amounts in Union, Whiteside, Monroe, Ogle, Stephenson, Kendall, Jo Daviess, McHenry, Greene, and La Salle. It is evident that the first two named counties produce the great volume of the limestone, the amount from Cook and Will counties together being \$1,567,977. Thus these two counties produce far more than the rest of the State put together. In the amount of limestone used for building purposes Illinois takes first place among the limestone-producing States. The amount devoted to building was valued at \$1,084,556. In the amount of limestone devoted to street work Illinois stands second among the limestone-producing States. The amount thus used was \$505,576. The value of the lime produced from limestone in this State, included in the total above given for the State, is \$366,245. As flux an amount valued at \$166,507 was used; for bridge work and miscellaneous purposes an amount valued at \$67,723. The operations in Cook and Will counties, on account of their magnitude, the general excellence of the stone produced, and the ease of quarrying and working out deserve special mention. The region embraced by these two counties is known generally as the Joliet region. It includes territory from about 5 miles south of the city of Joliet to about 10 to 12 miles north, taking in the towns of Lockport and Lemont and running along the valley of the Illinois river. Most of the quarries are situated on the banks of either the river or the canal. The stone exists in layers at the surface, varying from 1 inch to 3 inches in thickness, and growing in thickness with the increasing depth until at about 25 feet it is found of a thickness varying from 15 to 20 inches. It is, however, rarely quarried below the 25-foot level, owing to the expense of getting it out and dressing it, since at that depth it is much harder, although the quality of the stone is superior to that in the upper levels. At the depth of 25 feet the inflow of water materially adds to the expenses of quarrying. The stone found at or near the surface is almost valueless and is almost entirely thrown away in stripping the quarry. The next two-fifths furnish stone of sufficiently good quality to be used for riprap, rubble, sidewalks, and curbing. The last two-fifths contain the best stone, namely, that used for building. It is generally of a bluish-gray color. The exposed stone is of a yellowish color from the effects of exposure to the atmosphere. It is also true that most of the Joliet stone turns more or less yellow upon exposure. The beds are divided vertically by seams occurring at somewhat irregular intervals of from 12 to 50 feet, and continue with quite smooth faces for long distances, and also by a second set of seams running nearly at right angles with the first, but only continuous between main joints and occurring at very irregular intervals. This structure renders the rock very easily quarried and obtainable in blocks of almost any required lateral dimensions.



The stone is easily worked into required shapes and takes a fine, smooth finish, and is susceptible of being readily planed. This forms a very rapid and cheap method of finishing flagging stones and preparing such as are to receive a smooth finish on the polishing bed. Enormous quantities of flagging stone are taken out, most of which goes into Chicago; but business with other cities is decidedly on the increase. The finest varieties are readily produced in forms which are capable of being turned out by lathes.

The following is an analysis of Cook county limestone:

*Analysis of Cook county, Illinois, limestone.*

	Per cent.
Silica.....	26.08
Alumina and oxide of iron.....	6.57
Carbonate of lime.....	46.90
Carbonate of magnesia.....	14.19
Water.....	6.26
Total.....	100.00

The crushing strength of this stone is 16,017 pounds to the square inch; specific gravity, 2.512. The stone obtained in the vicinity of the towns of Sterling, Morrison, Fulton, Cordova, and Port Huron is largely burned into lime. This is true of much of the stone all along the Mississippi river. The best grades of Alton stone become whiter upon exposure to the air, and some of it that has stood in buildings for twenty to twenty-five years has become almost perfectly white. The quarry at the Chester, Illinois, State prison is an immense bluff about 200 feet in height. It has been worked for only the past two or three years and is now turning out fine stone. All work is done by the convicts.

*Sandstone.*—The sandstone of Illinois comes from counties in the north-western and western parts of the State. The total value of the product in 1889 was \$17,896. It came from the following counties, named in order of output: Henry, Fulton, Whiteside, Union, Knox, Lee, and Clay. By far the most, however, came from Henry county. It was nearly all used for building purposes.

#### INDIANA.

The kinds of stone produced in this State are limestone and sandstone. Much progress has been made in the stone industry in the last ten years.

*Limestone.*—The limestone produced in 1889, including the value of the lime made from it, was valued at \$1,889,336. The limestone industry is a very important one in this State. The productive counties are as follows, in the order of their relative magnitude: Lawrence, \$506,471; Huntington, \$228,679; Monroe, \$195,632; Decatur, \$169,195; Washington, \$137,200; Ripley, \$112,916; Owen, \$74,227; Clark, \$65,387; Franklin, \$51,558; Putnam, \$49,606; Wabash, \$38,640, and smaller amounts from Shelby, Grant, Carroll, Cass, Delaware, Howard, Black-



ford, Madison, Harrison, Jennings, Adams, Floyd, Wells, Crawford, Jackson, Jay, Fayette, Miami, Randolph, Vanderburg, Wayne and White. The most productive portions of the State are the southern and southeastern. The product of these portions amounts to \$1,312,586. The limestone of the State may for convenience be divided into three general classes: The oölitic limestone, otherwise known as cave limestone, from the numerous caverns which are to be found scattered through it; second, the harder and much more crystalline variety; and finally the rock which occurs in thin strata and which is well adapted for purposes of flagging, etc. The oölitic limestone extends in a southeastern direction from Greencastle in Putnam county. This stone is commonly known in trade as Indiana stone or Bedford stone and is well-known over a wide area in the United States and is an exceedingly popular building stone, not only in cities of the West, but in Eastern cities as well. It has been most extensively quarried at Stinesville, Ellettsville, and Bloomington, Monroe county, and at Bedford in Lawrence county; but owing to the increased demand for this stone, new quarries are being opened and extensively worked at frequent intervals along the line of the Louisville, New Albany, and Chicago railroad, from Gosport to Bedford, and these give promise of rich and practically inexhaustible supplies. This stone is almost exclusively used for building purposes, and it is the great production of this stone which enables Indiana to take second place among the States producing limestone for building purposes, Illinois standing in the first place. The stone is characterized by its oölitic character, is comparatively soft when first removed from the quarry, but hardens on exposure to air. The deposit varies from a few feet to a great many in thickness and it is practically free from fissures. Solid walls 40 to 50 feet in depth have already been revealed without a seam or fault of any kind from top to bottom. It is easily quarried in blocks of any size required, being cut from the solid mass by means of channelers. It is soft enough to be readily sawed, ordinary steel blades, with sand as the abrasive material, being used for sawing. Occasionally diamond saws are used with fine results. For most part the stone is fine grained, but contains also layers of coarser material in which shells are easily recognized with the unaided eye. Operations in all quarries producing this kind of stone are conducted on the largest scale and the machinery employed is usually of the very best.

The harder, more crystalline stone is found in the eastern and southeastern parts of the State, principally in Decatur county in the southeastern part. The quarries in general are rather small, there being twenty of them in Decatur county alone. Some of the quarries are operated on a large scale, as, for example, the Greensburg Limestone Company, the Big Four Company, and a number of others. On account of its hardness this stone can not be sawed. It is used quite largely for building purposes. In the northern and northeastern portions of



the State the stone is used somewhat for building and street purposes, and in Huntington county very largely for burning into lime. The great center of the lime industry is at Huntington, Huntington county. The most important concern producing lime at this point is the Western Lime Company. The product has a widespread reputation for use in building. On account of the flagging nature of the stone in the more northern portions of the State it is often quarried simply by aid of a pick and bar. This is more especially true in regard to the northeastern sections of the State. In the northern, northeastern, and eastern portions of Indiana are a great many small quarries. A number of them seem to be capable of more extended operations, but the lack of railroad facilities from the quarries to the main lines of travel exerts a retarding influence. The stone quarried at Greensburg, in Decatur county, is decidedly crystalline, and is susceptible of a high polish. The thin-bedded stone in the upper portions of these quarries is used to some extent for flagging. The development of the oölitic or Bedford stone is largely the result of operations conducted within a comparatively few years. In a small way it has been quarried and used for twenty-five years or more, but it is within the last twelve years that the stone has been recognized and appreciated by the larger cities of the East and West. It occupies at present a very prominent position among the best building stones of the country.

Considering the purposes to which the total limestone product of Indiana is devoted it appears that the value of the stone devoted to building purposes was \$994,313; the value of lime manufactured, coming chiefly from Huntington county, was \$340,315; to street and road work an amount valued at \$316,722 was devoted; to bridge work and light foundations \$233,710; and a small amount is used as flux. There are in all 172 limestone quarries in the State.

The following analyses may be found of interest:

*Analysis of limestone from Adams county, Indiana.*

	Per cent.
Carbonate of calcium.....	54.00
Carbonate of magnesium.....	45.00
Alumina.....	.46
Silica.....	.53
Iron.....	.01
Total.....	100.00

*Analysis of limestone from Howard county, Indiana.*

	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Iron.....	.001	.001	.008	None.	None.
Carbonate of magnesium....	Trace.	24.74	24.56	31.69	2.61
Carbonate of calcium .....	93.10	65.03	66.92	69.01	95.50
Insoluble matter incinerated.	1.62	3.08	5.56	3.84	.90
Insoluble matter dried at 100° .....	1.74	8.73	7.63	7.03	1.82



*Analysis of Lawrence county, Indiana, oolitic limestone.*

	Per cent.
Lime .....	53.55
Carbonic acid .....	43.33
Water .....	.56
Magnesia .....	
Iron .....	
Alumina .....	2.56
Manganese .....	
Phosphoric acid .....	
Silica .....	
Total .....	100.00

*Sandstone.*—The sandstone produced in 1889 was valued at \$43,983. It was produced in the four counties following: Warren, \$19,163; Fountain, \$14,500, and smaller amounts in Orange and Putnam counties. There are in all eleven quarries. Of the total amount produced, \$16,033 worth was used for building purposes, whereas the entire product of Orange county was used for abrasive purposes. For bridge work, etc., an amount valued at \$18,080 was used. The sandstone of Orange county deserves especial mention on account of its value for abrasive purposes. This stone is said to need no oil to soften it, but is used with water alone, and it appears to be very popular for the purpose of sharpening tools. It has been very highly recommended for razor hones and sharpening axes and knives. It is found chiefly in the western part of Orange county, and appears to be produced in no other county of the State. Much of it is shipped in the rough to the various points in New York to be sawed. There are no works with good facilities for sawing the stone in the vicinity of the quarries. The presence of petrifications in these quarries occasions not a little trouble in working the stone.

## IOWA.

Limestone and sandstone are produced in this State.

*Limestone.*—In 1889 the total value of the limestone product was \$530,863. It came mainly from counties in the eastern and southeastern parts of the State. The limestone quarries are in a great many cases scarcely worthy of the name quarry, the operations being extremely limited and carried on frequently as work incidental to farming. There are comparatively few large operations in the State. It will, however, be noted that the value of the total output is considerable. The productive counties are as follows: Jackson, \$97,600; Dubuque, \$96,168; Cedar, \$67,941; Marshall, \$51,400; Jones, \$37,880; Scott, \$31,081; Lee, \$20,093; Clinton, \$14,631, and smaller amounts from Des Moines, Madison, Decatur, Cerro Gordo, Dallas, Wapello, Linn, Muscatine, Black Hawk, Mahaska, Washington, Benton, Clayton, Pocahontas, Montgomery, Tama, Floyd, Adams, Mitchell, Humboldt, Johnson, Jefferson, Clark, Van Buren, Howard, Taylor, Keokuk, Potawatamie, Louisa, Webster, Allamakee, Story and Buchanan. The



number of quarries is 143. Of the total product an amount valued at \$236,792 was devoted to building purposes, while the value of the lime produced is \$170,043. The remainder was divided between street and road work and bridge piers and foundations.

*Sandstone.*—Eleven quarries in this State produced sandstone valued at a total of \$80,251. The productive counties are: Marion, \$61,451, and Hardin, \$10,197. The remainder producing small amounts are Cerro Gordo, Clayton, Lee, Jasper, Washington and Scott. The stone is almost entirely used for general building purposes.

*New and prospective developments.*—The following new limestone quarries were opened in 1890 by Mr. F. C. Chesterman, of Dubuque; Mr. Warren Bailey, of Cedar Falls, and Most & Stearns, of Humboldt.

#### KANSAS.

Limestone and sandstone were both produced in this State in 1889. The limestone was valued at \$478,822, the sandstone at \$149,289.

*Limestone.*—This comes from 115 quarries, many of them, however, very small, and contained in the following counties of the State: Cowley, \$95,000; Leavenworth, \$65,387; Marshall, \$57,700; Chase, \$53,000; Ripley, \$52,000; Butler, 47,000; Lyon, \$19,000; Wyandotte, \$19,000; and smaller amounts from Marion, Atchison, Wabaunsee, Shawnee, Washington, Johnson, Russell, Dickinson, Franklin, Morris, Elk, Brown, Douglas, Republic, Pottawatomie, Coffey, Anderson, Jefferson, Ness, Montgomery, Jackson, Harper, Sumner, Ellsworth and Osage. The stone is pretty well distributed over the eastern portion of the State. Most of it, however, comes from the vicinity of Atchison, Leavenworth, Topeka, and Fort Scott. Of the total production an amount valued at \$269,316 was used for building purposes. The value of the lime product is \$9,013. For street work \$97,502 worth was used; and for bridge, dam, and railroad work an amount valued at \$102,991.

The following is an analysis of Cowley county limestone made by Prof. F. W. Clarke, of the U. S. Geological Survey:

*Analysis of limestone from Cowley county, Kansas.*

	Per cent.
Silica.....	5.27
Water.....	.78
Ferric oxide.....	.71
Ferrous oxide.....	.32
Alumina.....	1.07
Carbonic acid.....	40.34
Lime.....	50.36
Magnesia.....	.86
Sulphuric acid.....	.07
Phosphoric acid.....	.06
Soda.....	.20
Potassa.....	.10
Total.....	99.84
Matter dried at 100°.	



According to the tests made in Washington a 2-inch cube crushed at 29,490 pounds.

*Sandstone.*—The sandstone product came from the following counties, named in order of value of output: Bourbon, \$90,000; Phillips, \$35,086; Rawlins, \$18,000, and smaller amounts from Crawford, Woodson, Clark, Wilson, Kingman, Harper and Comanche counties. The sandstone is found in all parts of the State, but the most productive portions are in the south and southeast. The product was used mainly for street work, a smaller quantity being devoted to building purposes.

#### KENTUCKY.

Sandstone and limestone were produced in this State in 1889. The value of the limestone produced was \$303,314, while that of the sandstone was \$117,940.

*Limestone.*—The limestone comes from fifty-four quarries scattered over the following counties, named in order of output: Warren, \$128,000; Jefferson, \$76,000; Kenton, \$36,000; Fayette, \$17,300; Pendleton, \$14,000; Lyon, \$7,000, and smaller amounts from Jessamine, Menifee, Logan, Montgomery, Caldwell, Crittenden, Boyd, Marion, Hardin, Washington, Carter and Trigg. The purposes for which the stone was used were mainly for building, to which was devoted the amount valued at \$187,570; \$24,414 is the value of lime produced. To street work an amount valued at \$86,054 was applied. Smaller amounts were used for flux and for bridge work. The product of Warren is deserving of special notice because of its peculiarities and its value as a building stone. This stone is known commercially as Bowling Green oölite. It is quite different from the oölitic stone of Indiana, inasmuch as it belongs to another limestone group, the constituent globules being large and distinct, whereas in most of the Indiana stone they are minute. It is quite similar to the Portland oölite of Ireland. The following analyses of Bowling Green and Portland oölite show the similarity between the two:

*Composition of Bowling Green, Kentucky, limestone compared with Portland, Ireland, limestone.*

	Bowling Green.	Portland.
	<i>Per cent.</i>	<i>Per cent.</i>
Carbonate of lime .....	95.31	95.16
Carbonate of magnesia.....	1.12	1.20
Silica.....	1.42	1.20
Water and loss.....	1.76	1.94
Iron and alumina.....	.39	.50
Total.....	100.00	100.00

The quarries are of large extent, well equipped with channeling machines, derricks, etc. A mill with twelve gangs of saws finishes the stone. Blocks of almost any size can be furnished. These quarries



were first opened in 1833, but until recently they were operated in the most primitive manner, and while the product has been used chiefly in the South, efforts are now being made to introduce the stone to the building trade of the northern States. Among the cities in which it has been most used are Louisville, Memphis, Nashville, and Bowling Green; to some extent also in Chicago. The stone is soft and easily worked, and like the Indiana stone hardens on exposure to the atmosphere. Carvings made upon the stone stand exposure to the air very well. Its color under the influence of sunlight tends to become continually lighter. Its crushing strength is such as to enable it to resist a pressure of 3,000 pounds to the square inch. When heated to redness on the surface and plunged into cold water it revealed no crack, even upon examination with a magnifying glass, and in some cases on being reheated for a second and third time and plunged into water still failed to present indications of cracking. According to present indications, the extended application of the stone in the northern and eastern portions of the country seems highly probable.

*Sandstone.*—The sandstone is produced from eleven quarries operated in seven counties of the State, namely: Rowan, \$52,400, Muhlenberg, \$25,000, Lewis, \$24,900, Bell, \$5,000, and smaller amounts from Crittenden, Rockcastle and Ohio. The greater portion of the stone, namely, \$77,877 worth, was used for building purposes, \$38,463 for bridge work, and a small quantity for street purposes.

#### MAINE.

The kinds of stone produced in this State, in order of commercial importance, are granite, limestone, and slate.

*Granite.*—In the value of granite produced in 1889 this State stood second in the list of all granite-producing States of the Union. The total value of the product was \$2,225,839. The counties producing this product are, in order of their importance: Knox, \$844,638, Hancock, \$685,720, Waldo, \$165,603, Kennebec, \$136,270, Washington, \$106,025, York, \$88,567, Franklin, \$72,033, and smaller amounts in Lincoln, Somerset, Penobscot, Cumberland, Androscoggin and Oxford. From the first seven counties above named comes the great bulk of the entire product. The most productive counties are those along the coast. The value of the granite devoted to building purposes is \$839,125. In the value of stone devoted to this purpose Maine is second only to Massachusetts, but in the value of stone devoted to street work, it stands first among all the granite-producing States, the total value of stone devoted to street work being \$927,949. Of this amount \$824,113 was the value of paving blocks, which were shipped to most of the large cities on the Atlantic coast, principally to New York. Considerable was devoted to cemetery and monumental work. Although Maine doubtless possesses much stone well adapted to these uses, it stands in fourth place among the granite-producing States in the value of output



for these purposes, being preceded by Rhode Island, Massachusetts, and Vermont, in the order named. The vast resources of this State in granite have been utilized to only a small fraction of the possibilities. The quarries situated along the coast have great advantages in the matter of transportation, inasmuch as this is largely by water and freight rates are naturally low. The granite quarries offer very excellent conditions for being worked. The stone opens easily, having peculiar co-hate joints that are such striking features of the syenite or granite of New England. Then there are generally at least two of these rift lines and there is a more or less complete division by what appear to be true beds as well as joints, so that the division of the rock is as complete as could be desired. At the same time the lines of weakness are not so numerous as to make the quarried masses in many cases too small for use, as is sometimes true of other regions. Many of the quarries on the coast are conducted on a very large scale with all the latest most improved facilities, not only for quarrying but for the subsequent handling and preparation of the stone for market. A shaft of granite 115 feet long and 10 feet square at the base and weighing 850 tons has recently been quarried. It is claimed to be the largest piece of stone ever quarried. It has not yet been utilized but is lying in the quarry yards at Vinal Haven. The color of the granite produced from quarries in Maine varies from light gray to black and red. From the commercial standpoint the most important are the lightest in color and the gray. The grain of the stone varies very much in size, that quarried at Augusta being quite fine, while the other extreme is seen in the product of the Biddeford quarries. The light-colored stone comes from Biddeford, Pownal, Norway, Lewiston, North Jay, and Augusta. In many cases the light-colored granite is interspersed with black spots of mica which render it unfit for fine work. Veins of quartz, and of quartz and feldspar are often quite troublesome. In many of the ledges, as for example those in Augusta, the stone lies in beds or sheets which are very easily loosened by a single blast. In many of the small quarries the method of quarrying and the tools employed are simple and have undergone little improvement. This, however, is not true of the largest plants for producing this stone. Stone from South Thomaston and St. George is very dark in color and in the latter town are quarries of black stone and the only ones worked to any extent in the western portion of the State. The black granite is largely worked into monuments and it presents very fine contrasts between the black, polished faces and the lighter-colored hammered parts. Quite a large number of small quarries are operated by men whose main occupation is farming, but who work quarries for a small part of the year and with few quarrymen. The usual method in such cases is to secure a few contracts after haying season and they are fulfilled before cold weather. Such firms as these rarely keep any books and it was extremely difficult to determine the exact amount of yearly business done by them.



*Limestone.*—The limestone of Maine, and which is converted entirely into lime, comes for the greater part from Knox county. Smaller quantities are also produced in Waldo and Penobscot counties. In this limestone region there are sixty quarries producing stone which is converted almost on the spot into lime. The total value of the lime produced in 1889 was \$1,523,499. The stone is almost inexhaustible in quantity and is admirably adapted to the purpose for which it is used. Operations of quarrying consist simply in blasting by means of dynamite, which breaks the stone up at once into sizes suitable for use in the kilns. It is then hoisted out by means of improved cables and machinery and sent directly to the limekilns, which are favorably situated for transportation by water. The stone is partially crystalline, but very coarse grained. Fine crystals of calcite are very numerous and gypsum also occurs. The operations at the quarries near Rockland are all below the surface of the ground. The fuel used in the kilns is entirely wood, which is imported from Canada. The stone produced for burning into lime is not measured as such, but is measured only by the quantity of lime produced from it, so that in speaking of the amount of stone quarried the producers name the amounts of lime obtained from it, and the unit of measurement is a bushel or barrel of lime. The lime produced at Rockland is of fine character and is the standard lime of New York City, to which it is shipped in enormous quantities. Boston also forms an important market for the product.

*Slate.*—The slate product of Maine comes entirely from quarries in Piscataquis county. The output in 1889 was valued at \$219,500 for roofing purposes. This slate is of very superior quality.

*New and prospective developments.*—New granite quarries were opened during 1890 by the following firms: Messrs. Graves Bros., Northeast Bar Harbor; Mr. J. P. Fogg, of Pownal, and the Norway Granite Company, of Norway.

#### MARYLAND.

Granite, limestone, marble, and slate are produced in this State.

*Granite.*—Twenty-two quarries in Baltimore, Cecil, and Howard counties were operated in 1889, producing an output valued at a total of \$447,489. Of this amount Baltimore County yielded stone valued at \$223,070; Cecil, \$219,863; and a smaller amount came from Howard County. The granite quarry at Port Deposit has won a wide reputation for the satisfactory stone produced. Throughout the mass of this granite, as it occurs in the quarry, seams occur at intervals from about one-half inch to a number of feet, and while they are discernible only by an experienced eye, they are very valuable in the operations of quarrying and can be opened readily by means of wedge and feather. They frequently reveal a perfectly level surface, ready at once for use in building without the intervention of the stonecutter. The expense of preparing the rock for use in the wall is accordingly reduced. The



stone is very hard, takes a beautiful polish, retains its color, and can be gotten out in enormous blocks, larger, indeed, than it is advisable under ordinary circumstances to handle. It was used in the construction of the piers of the Baltimore and Ohio railroad bridge across the Susquehanna river near Perryville, and has given entire satisfaction in this work.

*New and prospective developments.*—In the spring and summer of 1890 the following firms began the operation of granite quarries: E. S. Johnson, of Guilford; Benjamin Kepner, of Port Deposit; Oliver and Peach, Granite; and M. C. Pyle & Son, of Pylesville. The Maryland Granite Company was incorporated, with a capital stock of \$200,000, in December, 1890. Its object is to operate granite quarries and to do a general stone-contracting business. They are said to have purchased 184 acres of land at Deer Creek for the development of granite. The African Granite Company was incorporated at Baltimore during 1890, with a capital stock of \$30,000.

*Sandstone.*—Sandstone was produced in this State in 1889, in Allegany and Frederick counties, in small amounts, the total value of the product of the State being valued at only \$10,605. The Potomac Red Sandstone Company is operating sandstone quarries on the Potomac river, about 20 miles above Washington, in Montgomery county. This stone has been quarried since 1884, but for a period of nine years previous to that date there was no production. This production was originally known as Seneca red sandstone. It has been used in quite a large number of buildings in Washington City, notably the Smithsonian Institution. From all the evidence which has been submitted, it appears to be one of the best red sandstones in the country. Many of the strong and unqualified indorsements of this stone appear as the favorable result of an investigation of a committee of Congress appointed to investigate the use of this stone in the construction of the War, State, and Navy Department building in Washington.

*Limestone.*—Ordinary limestone from thirty quarries was produced in 1889 to an amount valued at \$164,860. The productive counties were the following: Baltimore, \$102,350; Frederick, \$38,296; Washington, \$15,184; and much smaller amounts from Carroll, Allegany, and Howard counties. The great bulk of the product was used in the production of lime, which was valued at \$148,432. The remainder was used for building and street work, and to some extent as a flux and in bridge and railroad work.

*New and prospective developments.*—The Frederick Lime Company, of Frederick county, has been incorporated with a capital stock of \$50,000 to develop limestone quarries for the manufacture of lime. Operations began in November, 1890.

*Slate.*—The slate product of Maryland comes from what is known as the Peach Bottom region, in the northern part of Harford county, where there were five quarries in operation in 1889. They produced an



output valued at \$110,008. For a more detailed description of what is known as the Peach Bottom region and of the slate produced from it, see the report on Pennsylvania in this volume.

*Marble.*—The production of marble proper is limited to Baltimore county, at a number of points in the vicinity of Baltimore, along the Northern Central railroad. The total value of the output in 1889 was \$119,675. In Harford county green serpentine was quarried from a single locality. While this is by no means marble in constitution, it is nevertheless used for purposes to which marble is continually applied, and it therefore enters into competition with marble in the market. This stone is an exceedingly valuable one for purposes of interior decoration and furniture tops. The quarry was opened in the year 1880, and has been in operation ever since that time.

The following is an analysis of Harford county serpentine made by Dr. F. A. Genth, of Philadelphia.

*Analysis of serpentine from Harford county, Maryland.*

	Per cent.
Silicic acid .....	40.06
Alumina .....	1.37
Chromic oxide .....	.20
Nickel oxide .....	.71
Ferrous oxide .....	3.43
Manganous oxide .....	.09
Magnesia .....	39.02
Water .....	12.10
Magnetic iron .....	3.02
Total .....	100.00

The specific gravity of the stone is 2.668; hardness, 4 on a scale of 10.

*New and prospective developments.*—The Texas Lime Company began operations in quarrying marble for the production of lime in February, 1890. The Lake Chrome and Mineral Company opened a serpentine quarry in Harford county early in 1890.

#### MASSACHUSETTS.

Granite, sandstone, limestone, and marble are produced in this State.

*Granite.*—In the granite industry Massachusetts stood in first place among the granite-producing States in 1880 as well as 1889. It will moreover probably continue to hold this position for some years to come. The value of the granite output, according to the Tenth Census, in 1880 was \$1,329,315. The corresponding figures for 1889 are \$2,503,503. There were in 1889, 151 quarries, distributed over the following counties, named in order of value of product: Essex, \$778,366; Worcester, \$751,413; Norfolk, \$485,353; Middlesex, \$172,161; Bristol, \$164,337; Hampden, \$112,849, and very small quantities also from Franklin and Hampshire counties. The product was most largely used for general building purposes, the value of the stone devoted to those purposes being \$1,362,451. The value of the product devoted to



cemetery uses was \$497,438; for street work, \$466,147. The remainder was devoted to bridge, dam, and railroad work, and to various miscellaneous uses. It is evident that the granite comes mainly from the counties along the eastern coast and principally from the northeastern part of the State.

Among the various granites of the State that quarried at Quincy, which is a bluish-gray syenite, is perhaps the most interesting. It was the first to acquire a reputation, and the success of the Quincy granite did much towards stimulating search for similar products in other parts of the State. The quarries on Cape Ann, in Essex county, are being very rapidly and successfully developed, the quality of the stone produced here leaving little to be desired. Transportation facilities at the Cape Ann quarries could hardly be better, in view of the fact that they are immediately on the coast and, furthermore, in immediate communication with the Old Colony railroad. There is still, however, considerable need of good harbors at this locality, and considerable money must yet be spent there before quarrying can increase as it should.

The products of Massachusetts granite are so well known all over the country that it is necessary to say but little here in regard to them. Stone for all purposes is shipped all over the United States. The methods of quarrying and of cutting and polishing the stone in vogue in this State are fully up to date.

The following is an analysis of Bradford red granite, made by L. P. Kinnicutt, Ph. D., of the Worcester Polytechnic Institute.

*Analysis of Bradford, Massachusetts, red granite.*

	Percent.
Silica .....	73.73
Alumina and oxide of iron .....	16.95
Lime .....	1.05
Magnesia .....	trace.
Potassium oxide .....	8.15
Sodium oxide .....	.90
Loss and undetermined .....	.22
Total .....	100.00

The following is an analysis of Worcester granite. The analysis was made by Prof. C. F. Chandler, of New York.

*Analysis of Worcester, Massachusetts, granite.*

	Per cent.
Silica .....	78.07
Alumina .....	12.67
Iron peroxide .....	2.00
Manganese oxide .....	.03
Lime .....	.85
Magnesia .....	.10
Potash .....	4.71
Soda .....	3.37
Total .....	99.80



*New and prospective developments.*—New granite quarries were opened at various times in 1890 by the following firms: Messrs. Rowley & Hanscombe, of Lanesville; the Braintree Granite Company, of Boston; Messrs. Jones & Desmond, of West Quincy; Messrs. McDonald & Turner, of Quincy; the Old Colony Railroad Company, of Boston, and Messrs. Charles Johnson & Bros., of Quincy. Mr. J. T. Tank, of Providence, Rhode Island, opened a quarry in Worcester county.

*Sandstone.*—Sandstone was produced from 21 quarries, to an amount valued at \$649,097. The most important county is Hampden, in which the product was valued at \$563,179. Suffolk county produced an amount valued at \$82,018, while very small amounts came from Norfolk and Hampshire counties. The product is almost entirely used for general building purposes.

The following is an analysis of so-called Maynard sandstone, made by Dr. L. P. Kinnicutt.

*Analysis of Maynard, Massachusetts, sandstone.*

	Per cent.
Silica .....	79.38
Oxide of iron .....	2.43
Alumina .....	8.75
Lime .....	2.57
Soda and potassa .....	4.08
Carbonic acid, water, and loss .....	2.79
Total .....	100.00

The following is an analysis of Worcester sandstone, made by Dr. L. P. Kinnicutt.

*Analysis of Worcester, Massachusetts, sandstone.*

	Per cent.
Silica .....	88.89
Alumina .....	5.95
Iron oxide .....	1.79
Manganese dioxide .....	.41
Lime .....	.27
Potassa and soda .....	.86
Carbonic acid, water, and loss .....	1.83
Total .....	100.00

The following is an analysis of Kibbe quartz sandstone, made by Prof. C. F. Chandler, of New York.

*Analysis of Kibbe, Massachusetts, quartz sandstone.*

	Per cent.
Silica .....	81.38
Alumina .....	9.44
Oxide of iron .....	3.54
Lime .....	.76
Oxide of manganese .....	.11
Magnesia .....	.28
Carbonic acid, water, and loss .....	4.49
Total .....	100.00



*Limestone.*—The limestone of Massachusetts comes from twelve quarries in Berkshire county, in the western part of the State. The total product in 1889 was valued at \$119,978. Most of it was used for burning into lime. The remainder was devoted to building purposes and flux.

The following is an analysis of limestone from Berkshire county:

*Analysis of Berkshire county, Massachusetts, limestone.*

	Per cent.
Lime.....	95.66
Magnesia.....	.78
Oxide of iron and alumina.....	.17
Silica.....	1.14
Carbonic acid.....	None.
Loss at red heat (water).....	3.00
Total.....	100.73

*Marble.*—Marble was produced in small amount at Lee, Berkshire county.

#### MICHIGAN.

In 1889 sandstone, limestone, and slate were produced in this State.

*Sandstone.*—This was valued at \$246,570. By far the most important producing county is Houghton, which yielded a product valued at \$165,000. Marquette county, with a product valued at \$35,970 stood second, while smaller amounts were produced in Huron, Ionia, Ottawa and Hillsdale counties. Most of the product was used for building purposes, although it is important to note that \$27,800 worth were used for abrasive purposes, Michigan being one of the three or four States producing good abrasive material.

*Limestone.*—Limestone valued at a total of \$85,952 was produced in the following counties, named in order of their importance: Huron, \$40,272; Wayne, \$16,715; Emmet, \$13,100; and smaller amounts from Monroe, Delta and Alpena counties. Most of the product was used for building purposes, although some was burned into lime, and a slightly larger quantity used for street work, the rest being devoted for fluxing uses.

*Slate.*—The value of the slate produced in Baraga county was \$15,000.

*Marble.*—Marble has been discovered at Ishpeming, Marquette county, and is said to be of very fine quality, even comparing favorably with the Mexican onyx. It must be said, however, that no full and definite information is yet at hand in regard to this discovery.

#### MINNESOTA.

The advances made by this State in the stone industry since 1880 are very remarkable. According to the census of 1880 the total number of quarries in Minnesota was 41 for all kinds of stone, and the total value of the product in that year was \$255,818. In 1889 there were 102 quar-



ries producing limestone, granite, and sandstone. The total value of the product of all kinds of stone in that year was \$1,102,008.

*Granite.*—The value of the granite produced in 1889 was \$356,782. The product came from 23 quarries scattered over the following counties: Stearns, \$139,265, Benton, \$110,650, Bigstone, \$95,000. Decidedly smaller quantities came from Sherburne, Morrison and Nicollet. The productive counties in 1880 were Benton, Sherburne and Chisago, and the product at that time was valued at \$28,815. The figures speak plainly for themselves as to the great strides which have been made in granite production. The product was devoted most largely to building, the value of the stone thus used being \$209,396; for street work an amount valued at \$141,554 was applied. Comparatively very small amounts were devoted to cemetery and bridge work.

*Sandstone.*—The value of the sandstone output in 1880 was \$41,150; in 1889 it was \$131,979. The product came from seven quarries operated in the following counties: Pine, \$89,750, Pipestone, \$20,279, St. Louis, \$13,950, and smaller amounts in Houston, Rock and Scott counties. Of the total value, \$82,000 worth was devoted to building purposes and the remainder between street and bridge work. The developments which have been made in Pipestone county in what is commercially known as "Pipestone red jasper" are of particular interest. This is a metamorphic quartzite rock of intense hardness, varying in color from cherry to lavender or violet. Its extreme hardness is another important characteristic. The following analysis was made by Dr. C. T. Jackson:

*Analysis of red pipestone from Pipestone county, Minnesota.*

	Per cent.
Water.....	8.4
Silica.....	48.2
Alumina.....	28.2
Magnesia.....	6.0
Peroxide of iron.....	5.0
Oxide of manganese.....	.6
Carbonate of lime.....	2.6
Loss.....	1.0
Total.....	100.0

The following tests of this stone have been made:

*Tests of Minnesota red pipestone.*

Crushing strength.....	pounds per square inch..	23,000
Specific gravity.....		2.8
Weight per cubic foot.....	pounds..	170.6

On account of its color and desirable properties which tend to make the stone durable, it is quite popular as a building material and has already been used in the construction of quite a large number of important buildings.

*Limestone.*—In 1880 limestone was produced from thirty-three quarries scattered over eleven counties of the State. In 1889 the limestone



came from seventy-two quarries contained in fifteen counties. Named in the order of the value of their output, these counties are as follows: Hennepin, \$137,728; Blue Earth, \$127,279; Ramsey, \$103,929; Goodhue, \$95,938; Le Sueur, \$41,553; Scott, \$34,030; Washington, \$16,387; Winona, \$13,695; Wabasha, \$12,050; Rice, \$9,700, and smaller amounts from Dodge, Houston, Brown, Fillmore and Olmsted. The total product was valued at \$613,247. Of this an amount valued at \$380,556 was used for building purposes, while \$124,266 was the value of the lime produced. Smaller amounts were devoted to street and bridge work. The great bulk of the limestone comes from counties situated in the southeastern part of the State, where the cities of Minneapolis and Saint Paul form important outlets.

#### MISSOURI.

The kinds of stone produced in this State are granite, sandstone and limestone.

*Granite.*—The total value of the granite produced in 1889 is \$500,642. The product came from four neighboring counties in the southeastern part of the State. They are as follows: Iron, \$373,558; Wayne, \$63,842; Saint François, \$60,842, and smaller amounts from Madison county. There are ten quarries contained in this area. The stone was about equally divided between general building purposes and paving blocks. The value of the stone devoted to building is \$219,518. The value of paving blocks produced is \$216,986. To bridge, dam and railroad work an amount valued at \$63,638 was applied. A very small quantity was devoted to cemetery uses. The granite-quarrying industry dates back to a short time previous to 1880, but it at present bids fair to develop into an industry of considerable importance to the State. The most extensive quarries are at Graniteville, Iron county. The various plants at this locality are well equipped and supplied with improved machinery. Many of the finest buildings in Saint Louis have been constructed of this stone. At Granite Bend, Wayne county, are extensive granite quarries well equipped. In 1887 a shaft 85 feet deep with drifts extending from the bottom of the shaft in various directions was sunk. It was then charged with 32,700 pounds of black powder. The result of the blast was such that they have stone enough broken up to supply the demands of the firm for fifty years. The cost of the blast was \$16,000. Unquestionably the granite industry in Missouri, although at present in its infancy, may easily assume vast proportions in the near future.

*Sandstone.*—Sandstone valued at a total of \$155,557 was quarried in the following counties of the State: Johnson, \$100,184; St. Clair, \$15,000; Cape Girardeau, \$12,734, and smaller amounts in Carroll, Barton, Saline, Franklin, Vernon, Holt, Lewis, Buchanan and Henry counties.



*Limestone.*—The limestone industry in Missouri is a very large and important one. A product valued at \$1,859,960 was produced in 1889. This includes the value of all lime produced, namely, to an amount valued at \$465,390. The productive counties are the following: Saint Louis, \$870,276; Jackson, \$211,743; Marion, \$151,908; Greene, \$103,324; Buchanan, \$82,301; Dade, \$72,327; Pike, \$68,127; Jasper, \$41,000; Perry, \$33,070; Clark, \$28,563; Mercer, \$26,287; Lawrence, \$26,060; Callaway, \$24,500; and smaller amounts in Jefferson, Lewis, Wright, Cape Girardeau, Livingston, Andrew, St. Charles, Macon, Clay, Pettis, Cole, Linn, Caldwell, Sullivan, Randolph, Ray, Harrison, Monroe, Saline, Boone, Henry, De Kalb, Webster and Nodaway. The purposes to which the product was devoted are as follows: For building purposes, \$542,871; the value of lime produced, \$465,390; for street work, \$670,351; for bridge, dam, and railroad work, \$169,720, and small amounts for flux and miscellaneous uses. It is evident that by far the most important county producing limestone is Saint Louis county. Many quarries in and around the city of Saint Louis are operated. The stone is used for purposes of heavy construction, such as bridge and railroad masonry, building, paving, macadam, riprap, and the manufacture of lime. It is of excellent quality and shows great strength. In some of the quarries steam drills are in use, but in most of them the old methods are adhered to. The manufacture of a superior quality of lime in Saint Louis has grown to be an immense industry. Most of the kilns are located just outside of the city limits; they are well equipped and numerous. The product is almost entirely used in Saint Louis.

The following are analyses of limestone from various localities:

*Analysis of Marion county, Missouri, limestone.*

[By Regis Chauvenet & Brother.]

	Per cent.
Silica.....	.08
Alumina and oxide of iron.....	.40
Magnesia.....	.02
Carbonate of lime.....	98.80
Total .....	99.30

These chemists state that this is the purest sample of limestone they have ever analyzed, leaving nothing to be desired for whiteness and purity.



*Analysis of Ash Grove white lime.*

[By Charles W. Eoff, chemist.]

	Per cent.
Carbonate of lime .....	99.815
Magnesia .....	Trace.
Alumina .....	.054
Oxide of manganese .....	Trace.
Oxide of iron .....	.011
Silicic acid .....	.12
Phosphoric acid .....	None.
Sulphuric acid .....	Trace.
Total .....	100.000

*Analysis of Champion white limestone, Ash Grove, Missouri.*

[By W. D. Church.]

	Per cent.
Carbonate of lime .....	92.750
Carbonate of magnesia .....	3.260
Silica and insoluble matter .....	.495
Alumina .....	.480
Oxide of iron .....	.400
Sulphate of calcium .....	Trace.
Water .....	.675
Alkalies and loss .....	1.940
Total .....	100.000

*Analysis of limestone from Saint Louis county.*

	Per cent.
Carbonate of lime .....	97.76
Carbonate of magnesia .....	.12
Insoluble matter .....	.26
Oxide of iron .....	.20
Total .....	98.34

*Analysis of Lawrence county limestone.*

[By J. F. Elson, of New Albany, Indiana.]

	Per cent.
Carbonate of lime .....	85.373
Carbonate of magnesia .....	12.112
Silica .....	1.289
Alumina .....	1.134
Iron .....	.001
Undetermined .....	.091
Total .....	100.000



In northern Missouri limestone is found in every county and is quarried to a greater or less extent over the entire region. With but a few exceptions the quarries are worked on a small scale. The product is used in the immediate vicinity for foundations, cellars, wells, etc. The quarries are generally owned and operated by farmers, who do no work beyond the immediate local demand. Lack of facilities for transportation makes quarrying too expensive to be entered into as a business. Quarries adjacent to Government works on the Missouri and Mississippi rivers have supplied quite an amount for riprap. At Ash Grove, Missouri, are very extensive limekilns. A large quantity of lime is manufactured of a superior quality. The demand for this lime is very great. It is largely shipped to Alabama, Tennessee, Texas, Arkansas and Kansas, besides being also very largely used in Missouri. Extensive plants for burning limestone into lime are operated at Springfield, the product being used in Springfield, Kansas City and Saint Louis. At Cape Girardeau a large quantity of lime of good quality is also produced. At this locality crude petroleum is used as fuel, and it is claimed that a whiter and stronger lime is obtained than can be produced by either wood or coal. The limestone quarries at Grafton produced stone which has been found most excellently adapted for foundation purposes. It is the stone chiefly used in the construction of the great Eads bridge across the Mississippi river.

*Onyx.*—Quite recently discoveries of onyx have been made in Crawford and Pulaski counties; also in Wright county a deposit has been discovered. A company has been formed to develop the industry and active work will soon be begun. This onyx is taken from what is known as the Ozark region, being found in caves in the Ozark mountains within 70 miles of Saint Louis.

#### MONTANA.

*Granite.*—Granite was produced from a single quarry in Lewis and Clarke county in comparatively small amount. It was entirely used for building purposes.

*Limestone.*—Limestone was produced to the value of \$24,964 from four quarries situated, in the order of their values, in Jefferson, Missoula, Park and Cascade counties. Sixteen thousand dollars worth of the product was used as flux and a small quantity for burning into lime, and about \$8,000 worth for building purposes.

*Sandstone.*—Six quarries at various localities in Deer Lodge, Cascade, Custer and Yellowstone counties produced sandstone valued at \$31,648. It was entirely used for building. About half the product came from Deer Lodge county.

#### NEBRASKA.

Limestone only was produced in this State. The value of the output was in 1889, \$207,019, including the value of lime produced from it.



The productive counties are as follows: Cass, \$148,567; Gage, \$24,552; Sarpy, \$13,339, and smaller amounts from Nemaha, Jefferson, Pawnee and Thayer. Ninety thousand five hundred and forty-two dollars worth were used for building; \$86,643 for street work, while for flux and bridge work smaller amounts were used. The product comes entirely from the southeastern part of the State.

## NEVADA.

This State produced very small quantities of granite and sandstone.

The granite came from Washoe county. A new granite quarry was opened in September, 1890, by Mr. J. M. McCormick, of Reno.

The sandstone came from Ormsby county.

The product of this State was sufficient in amount for nothing more than building and street work in Carson City, to which probably the most of it went.

## NEW HAMPSHIRE.

*Granite.*—The granite produced in this State in 1889 was valued at \$727,531. The entire southern and middle parts of the State, with the exception of Belknap county, were productive of granite. There are seventy-eight quarries in the State, operating in the following counties: Carroll, \$197,284; Cheshire, \$189,590; Hillsboro, \$182,847; Merrimac, \$112,853; Strafford, \$22,535, and smaller amounts in Grafton, Sullivan and Rockingham counties. Of the total product an amount valued at \$324,567 was devoted to building purposes; to street work, \$252,256. Of this latter value \$87,569 was the value of the output of paving blocks. To cemetery and ornamental work an amount valued at \$135,029 was used. For bridge and miscellaneous purposes an amount valued at \$15,679 was used.

A resident of New Hampshire has developed a new use for granite, which consists in finely crushing the stone and afterwards molding it into the desired shape, and by the action of heat it is hardened and made to resemble closely the original granite, and it is said that to all appearances it is as strong and durable. Nothing can yet be said of the real value of this process, but experiments are yet being made.

*New and prospective developments.*—New granite quarries were opened in the spring, summer, and fall of 1890, by the following firms: Messrs. Bishop & Shalon, of Milford; Mr. William E. Elder, of Dover; Messrs. Lewis & Flanders, of Enfield; Mr. D. J. Winn, of Haverhill; the Troy Granite Company, of Worcester, Massachusetts (their quarry is located in Cheshire county, New Hampshire), and Mr. L. K. Hutchinson, of Milford.

*Sandstone.*—A trifling amount of sandstone, which, however, was entirely used for abrasive purposes, was produced in Grafton county in 1889.



## NEW JERSEY.

Granite, sandstone, limestone, slate, and bluestone were produced in this State in 1889.

*Granite.*—The total value of the granite produced in New Jersey in 1889 was \$425,673. It came mainly from the northern and northeastern parts of the State, and the markets for it are largely New York City and Jersey City. The productive counties, in order of importance, are as follows: Somerset, \$86,250; Hudson, \$81,500; Essex, \$79,200; Sussex, \$52,000; Passaic, \$37,760; Mercer, \$27,513; Hunterdon, \$24,800, and smaller amounts in Union and Morris counties. There are in all twenty-three productive quarries. Of the total output an amount valued at \$236,310 was devoted to street work, including the value of all paving blocks produced, which amounted to \$168,555; to general building purposes an amount valued at \$42,175; for bridge, dam, and railroad work, \$147,063. A trifling amount was devoted to cemetery purposes.

*New and prospective developments.*—New quarries were opened in the spring and summer of 1890 by the following companies: The Waterloo Ice Company, of Newark; Thomas Nevins & Son, of Orange, and York & Bittenbender, of Belvidere.

*Sandstone.*—Sandstone was produced in 1889 to an amount valued at \$597,309. It came from twenty-six quarries, scattered over the following counties, named in order of importance: Essex, \$270,450; Hunterdon, \$173,007; Mercer, \$77,652; Passaic, \$63,200; and Somerset, \$13,000. The amount devoted to building purposes was valued at \$486,788; for bridge, dam, and railroad work the amount used was \$100,521.

*Limestone.*—The value of the limestone output of New Jersey in 1889 was \$129,662. It came from 33 quarries operated in the following counties: Sussex, \$72,529; Hunterdon, \$37,378, and smaller amounts in Warren, Somerset and Morris counties. The value of the lime produced was \$99,406; for flux an amount valued at \$29,620 was used, and a trifling amount for building. The following is an analysis of Hunterdon county limestone:

*Analysis of Hunterdon county, New Jersey, limestone.*

	Per cent.
Carbonate of lime .....	53.643
Silica .....	2.100
Carbonate of magnesia .....	40.750
Alumina .....	.252
Oxide of iron .....	.798
Total .....	97.543

This lime is especially valuable for fertilizing purposes.

*Slate.*—A small quantity of slate was produced in Sussex and Warren counties, New Jersey. Most of it was used for roofing purposes.

*New and prospective developments.*—A new slate quarry was opened by Messrs. Staton & Jones, at Lafayette, in the summer of 1890.



*Bluestone.*—Bluestone similar to that obtained in Pennsylvania and New York, and used mainly for flagging purposes, was produced in small quantities in Hunterdon and Sussex counties in 1889.

#### NEW MEXICO.

The kinds of stone produced in this Territory in 1889 were sandstone and limestone. The former was valued at \$186,804, the latter at only \$3,862.

*Sandstone.*—Sandstone was produced at eleven different quarries situated in the following counties, named in the order of their relative importance: San Miguel, \$139,124; Santa Fé, \$19,800; and Rio Arriba county, \$14,100. Small amounts also were produced in Valencia and Lincoln counties. Nearly the entire product was used for local building purposes, a very small quantity being devoted to street and bridge work.

*Limestone.*—The small limestone output was obtained from the following four counties: San Miguel, Lincoln, Sierra, and Santa Fé. The product was mostly burned into lime for local consumption.

*Ricolite.*—This name was given by Mrs. L. J. Cadwell, of Chicago, to a stone now quarried in the western part of Grant county. It resembles Mexican onyx, but is quite different in composition. It is susceptible of a very high polish, and is of a variety of colors. It can also be carved, and in this respect, as in others, differs from the Mexican onyx. Contracts to supply this stone for interior decoration in a number of buildings in Chicago have been signed.

#### NEW YORK.

The kinds of stone produced in this State include granite, sandstone, bluestone, limestone, marble, and slate. Among the stone-producing States New York stands third, being preceded by Pennsylvania and Ohio in the order named. In the number of kinds of stone produced, however, it is second to none.

*Granite.*—The value of the granite output in 1889 was \$222,773. The product comes from the following counties: Essex, \$85,200; Richmond, \$30,000; Orange, \$29,803; Westchester, \$16,000, and smaller amounts from Jefferson, Putnam and Rockland counties. The product was mainly used for building purposes, the amount devoted to these uses being valued at \$149,700. The remainder was divided between street, cemetery and ornamental work and bridge, dam and railroad uses.

*Sandstone.*—The sandstone of New York includes that which is recognized to the trade under the names of sandstone, brownstone, and bluestone, while the variety of sandstone known commercially as bluestone is hereinafter given by itself on account of its peculiar character and its almost exclusive application in street work for curbing and flagging. The value of the sandstone proper, exclusive of bluestone, produced in



1889 was \$702,419. The product came from sixty-three quarries scattered over the following counties: Orleans, \$573,773; Saint Lawrence, \$47,290, and smaller amounts from the following: Niagara, Oswego, Oneida, Jefferson, Chenango, Monroe, Allegany, Greene, Rockland, Washington, Tioga, Steuben, Schuyler, Franklin, Wyoming, Essex, Chautauqua, Otsego and Cattaraugus. Of the total amount produced, the value of that devoted to street work was \$459,158; to general building purposes an amount valued at \$241,216. A comparatively very small amount was devoted to bridge and miscellaneous work. As will be seen by an inspection of the productive counties, the greater part comes from the northwestern part of the State.

Among the sandstones deserving of special mention is what is known as the Potsdam red sandstone. This stone has been most thoroughly tested and has won a wide reputation for durability and its capacity to withstand the effects of strong heat and sudden cooling. It has been indorsed in a very unqualified manner by many of the leading authorities on structural material in the country.

*New and prospective developments.*—The following firms opened sandstone quarries in New York during 1890: Messrs. McVay, Tobin & Co., of Holley, Orleans county; Mr. Edward Jones, of Hulberton, New York, opened a sandstone quarry at Murray, Orleans county; Baldwin & Hinds, of Hindsburg, opened a sandstone quarry in Orleans county.

*Bluestone.*—This is the name given to the variety of sandstone which consists almost entirely of granules of silica cemented together by silica. The identity of this stone with sandstone is not generally recognized among the bluestone producers, and, in fact, many of them seem almost hurt if it is called sandstone. The bluestone industry is entirely distinct from what is herein given as the sandstone industry. Owing to the hardness and durability of bluestone, as well as the manner in which it occurs in the earth, it is well adapted to purposes of street paving, such as flagging and curbing, and most of it is devoted to these uses. A certain amount of the stone is quarried from regular organized quarries, with a definitely invested capital and plant, or facilities for quarrying, but in addition to stone taken from these regularly operated quarries a large amount is produced irregularly and spasmodically by men who invest no capital and have no definite organization as producers of stone. Their operations are conducted as follows: Provided with a very simple equipment of the most ordinary quarry tools they dislodge the stone found on land belonging to other persons and transport it to a number of shipping points, selling it there to dealers who make it a business to collect the stone in this manner and then ship it to the places where it is used. The dealers pay the individuals who quarry the stone an amount which simply compensates them for their time and labor, while the owner of the property receives a certain definite percentage from the dealer for the amount of stone thus taken from his land. During the year 1889, and a number of years previous,



some of the dealers at various points in New York State constituted the members of the Union Bluestone Company, with headquarters in New York city. Each member of this company was entitled to furnish a certain percentage of the total amount sold by this company in a given year. The dealers may, therefore, be regarded in a certain sense as producers. The land on which this stone is quarried is, generally speaking, of little value for anything but the bluestone contained in it. Originally, the stone was quarried for flagging only, but more recently it has been applied to quite a long list of purposes, such as rubble masonry, retaining walls and bridge stone, curbing, gutters, stepstones, flooring, vault covers, bases of tombstones, porch and hitching posts, house trimmings, such as platforms, steps, door and window sills, lintels and caps.

The stone is known commercially by quite a number of names which designate approximately the region from which it is taken. Among the names in common use may be mentioned the following: Hudson River bluestone, Hudson River flagging, North River bluestone, North River flagging, Pennsylvania bluestone, Wyoming Valley bluestone, Delaware River bluestone, Delaware flags, bluestone flagging and bluestone.

The value of the bluestone produced in New York in 1889 was \$1,303,321. This product came from 142 quarries in addition to numerous minor quarries or holes from which the product was taken by laborers, as has already been described. The productive counties are seen in the following list: Ulster, \$662,324; Delaware, \$150,866; Chenango, \$93,100; Sullivan, \$87,930; Wyoming, \$50,260; Schenectady, \$47,906; Orange, \$33,405; Albany, \$23,285, and smaller amounts from Otsego, Jefferson, Tompkins, Schoharie, Steuben, Seneca, Greene, Chemung, Broome, Saratoga, Oneida, Rockland, Franklin, Washington and Yates. The Union Bluestone Company, as organized in 1889, has dissolved.

*New and prospective developments.*—Messrs. Swartwout & Terry, of Read's Creek, Delaware county, and Mr. John McQuirk, of Hartwood, Sullivan county, New York, opened bluestone quarries during 1890.

*Limestone.*—Limestone, including the value of the lime made from it, was produced in 1889 to the value of \$1,708,830. The product came from 157 quarries distributed as shown in the following list of counties: Erie, \$331,011; Onondaga, \$180,849; Washington, \$172,987; Ulster, \$107,683; Rockland, \$104,000; Warren, \$103,600; Montgomery, \$95,319; Monroe, \$94,891; Westchester, \$83,313, and smaller amounts from Jefferson, Schoharie, Clinton, Niagara, Genesee, Cayuga, Albany, Oneida, Greene, Saint Lawrence, Orange, Saratoga, Lewis, Herkimer, Wayne, Seneca, Orleans, Essex, Fulton, Rensselaer, Madison, Otsego, Yates and Wyoming. The value of the lime produced is \$837,613. The stone used for building was valued at \$444,291. For street and road work an amount valued at \$197,091 was used, and for bridge, dam and railroad work \$175,736 worth.



*New and prospective developments.*—The following firms opened limestone quarries in 1890: Messrs. Schumacher & Edwards, of Buffalo, at Eggertsville, Erie county; Mr. J. H. Gould, Smiths Landing, Greene county; and Messrs. Andrews, Warner & Co., of Le Roy, Genesee county.

*Marble.*—The value of the marble output of this State in 1889 was \$354,197. The product came from thirteen quarries, operated in four counties of the State. They are as follows: St. Lawrence, \$138,200; Westchester, \$135,104; Columbia, \$54,717; and Warren, \$26,176. The St. Lawrence county marble varies from white to dark blue and green in color, and mixtures of these shades produce in some cases a mottled appearance. The stone is adapted to monumental work, but is mainly used for building purposes. In general it is too coarsely crystalline for fine carving, scroll work, or tracing. In Westchester county the most important localities producing marble are Tuckahoe and Pleasantville. This product is especially well adapted for use in the preparation of carbonic acid.

*New and prospective developments.*—The following persons opened marble quarries during 1890: Mr. Mark W. Spaulding, Rensselaer Falls, Saint Lawrence county; Mr. Thomas S. Clarkson, Potsdam, Saint Lawrence county; and Mr. John Webb, jr., Gouverneur, Saint Lawrence county. Mr. M. W. Spaulding, of Rensselaer Falls, also opened a serpentine marble quarry in July, 1890.

*Slate.*—The slate output of New York State in 1889 was valued at \$126,603. The product came from sixteen quarries in Washington county. This is the only locality in the world at which red slate is produced. The prices received for this variety of slate are much better than those which hold for the product from the neighboring slate regions of Vermont.

*New and prospective developments.*—Messrs. R. R. Jones & Co., of Middle Granville, Washington county, N. Y., opened a slate quarry during 1890.

#### NORTH CAROLINA.

Granite and a very small quantity of sandstone were produced in 1889. The granite was valued at \$146,627, and was obtained from twenty-two quarries scattered over the following counties, named in the order of their outputs: Vance, \$88,737; Iredell, \$22,860; Anson, \$10,000, and smaller amounts from McDowell, Rowan, Guilford, Gaston, Burke, and Wake counties. Of the total output \$44,000 worth was used for bridge work, \$42,000 for street work, and the rest was distributed between building and cemetery purposes.

*New and prospective developments.*—Three quarries of granite in the vicinity of Salisbury have recently been opened. The Stone Mountain Granite Company recently commenced operations in Rowan county. It is expected that quarries will be developed according to the most



improved methods, with a view of supplying local demands and also of putting the stone upon the market in competition with granite from Northern centers. Near Mount Ayre the Mount Ayre Granite Company has commenced quarrying operations on quite a large scale for the purpose of supplying paving blocks for a number of cities, among which may be specially mentioned Cincinnati, Ohio. The recently organized Dunn Mountain Granite Company, of Salisbury, is about to commence the development of granite quarries in that locality.

*Sandstone.*—A recent scientific examination of Moore county brown stone, contained in property in the vicinity of Carthage, has been made by Mr. Henry E. Colton, of Chattanooga, Tennessee. The results of this examination are decidedly favorable to the quality of the stone. It is probable that quarrying operations will be undertaken in the near future. The stone is so situated as to be quarried with a minimum of expense.

*Marble.*—A large deposit of white marble in McDowell county has been examined by experts and is reported both as being of fine quality and of large extent. A plant valued at \$50,000 has recently been established for the purpose of quarrying marble in Cherokee county.

*Slate.*—Deposits of slate in Montgomery county have recently been discovered, and steps toward their development have been taken by Mr. C. C. Wade. The North Carolina Slate Company has recently applied to the legislature of the State for an act of incorporation.

#### OHIO.

The kinds of stone produced in this State are exclusively sandstone and limestone. The total output of sandstone in 1889 was valued at \$3,046,656. In the production of sandstone Ohio stands in first place among the sandstone-producing States of the Union and second in the value of its total stone output. The next State in order in 1889 was Pennsylvania, with an output valued at \$1,609,159. It is thus evident that Ohio not only occupied first place, but was largely in advance of the State standing second.

*Sandstone.*—One hundred and ninety-two quarries were operated in 1889. The product came from the following counties, named in the order of the value of their output: Cuyahoga, \$1,118,409; Lorain, \$1,067,240; Stark, \$140,426; Scioto, \$71,700; Washington, \$59,736; Huron, \$59,118; Fairfield, \$57,162; Summit, \$50,310; Trumbull, \$41,440; Morrow, \$41,037; Wayne, \$29,250; Muskingum, \$25,095, and smaller amounts from Crawford, Richland, Holmes, Harrison, Tuscarawas, Belmont, Jefferson, Mahoning, Erie, Delaware, Franklin, Lucas, Meigs, Montgomery, Ross, Licking, Guernsey, Columbiana, Perry, Portage, Wood, Ashland, Pike and Lawrence. It is evident that by far the most of the stone comes from Cuyahoga and Lorain counties, in the northern part of the State. The stone was used for the following purposes: Building, \$1,846,918; abrasive purposes, \$525,548; street work, \$430,552, and the remainder



was used for bridge, dam, and railroad work and for miscellaneous purposes. In the production of stone for abrasive purposes Ohio stands first. The total value of the stone produced in 1889 for these purposes was \$580,000, so that it is evident that Ohio produces nearly the entire amount. Some of the sandstone quarries of Cuyahoga and Lorain counties are operated in a most thorough, complete, and economical manner; the latest appliances are in use, and for smoothness of working very few quarries in the country can compare with them. The operations of the Cleveland Stone Company are the most important. The use of the Knox system of blasting in the quarries of this company is attended with great success. The stone is of such a thoroughly homogenous character that the result of a blast by the Knox system is simply to move, slightly, large masses of stone without sprawling or weakening them in any manner. It might almost be said that one could stand upon the mass of rock while being blasted out without danger of personal injury.

The following are a number of analyses of sandstone taken from various quarries in the State:

*Analyses of Ohio sandstone.*

	No. 1. Buff.	No. 2. Berea.	No. 3. Euclid bluestone.	No. 4. Columbia.	No. 5. Elyria.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
Silica.....	97.00	96.90	95.00	96.59	87.66
Alumina.....			2.50		1.72
Iron oxides.....	1.00	1.68	1.00		3.52
Lime.....	1.15	.55		1.00	.17
Magnesia.....					.20
Potash and soda.....	.64	.55		.50	
Carbonic acid, water, and loss.....	.21	.32	1.50	2.00	2.03
Total.....	100.00	100.00	100.00	100.00	100.00

No. 1 came from Amherst, Ohio; No. 2, from Berea; No. 3, from Euclid county; No. 4, from Columbia county, and No. 5, from Grafton, Ohio.

The analyses of Nos. 1 and 2 were made by Messrs. J. H. Salesbury and John Eisenmann, respectively, and No. 5 by Mr. F. F. Jewett.

The sandstone of Ohio is so well known all over the country as a building and grindstone material that it is necessary to say very little here in regard to its desirable qualities. It is shipped practically over the entire United States.

*New and prospective developments.*—Developments of new quarries are rapidly being made both by companies long established as well as by new ones which are forming from year to year. The following firms opened new sandstone quarries during 1890: Mr. T. S. Gerhard, of Independence Township, Cuyahoga county; Mr. J. M. Crouch, of Gann, Knox county; Mr. J. N. Kisner, of Warsaw, Coshocton county; Mr. R. G. Garver, of Wilmot, Stark county; the Youngstown Stone Company, of Youngstown, Mahoning county; Messrs. Richard & Dicky, of Mill Rock, Columbiana county, and Mr. H. M. Friend, of Summit Hill, Ross county. The Uniontown Firestone Company, of Uniontown,



Pennsylvania, began to operate a sandstone quarry at New Lisbon, Columbiana county, in August of 1890.

*Limestone.*—The Ohio limestone, including the value of lime produced from it, amounted to a value of \$1,514,934 in 1889. It came from the following counties, named in the order of their importance: Ottawa, \$230,485; Stark, \$132,821; Erie, \$128,169; Clark, \$101,707; Miami, \$91,810; Montgomery, \$87,650; Wood, \$79,799; Franklin, \$76,778; Seneca, \$68,772; Lucas, \$53,568; Preble, \$52,700; Sandusky, \$52,122; Hamilton, \$49,683; Allen, \$42,515; Hancock, \$37,253; Highland, \$35,557; and smaller amounts from Greene, Hardin, Lawrence, Wyandotte, Butler, Delaware, Muskingum, Scioto, Shelby, Van Wert, Logan, Guernsey, Jackson, Putnam, Clermont, Crawford and Clinton. The value of the lime produced from the limestone of the State in 1889 was \$581,325. For building purposes an amount valued at \$407,388 was used; for street and road work the amount used was \$183,235. An amount valued at \$105,963 was used for flux. The remainder was devoted to bridge, dam and railroad work mainly. It is evident from the consideration of the productive counties that most of the limestone comes from the western part of the State, particularly the northwestern part.

The following analyses of limestone in Ohio are presented:

*Analyses of Ohio limestone.*

No.	Locality.	Carbonate of lime.	Carbonate of magnesia.	Alumina and oxide of iron.	Silica.	Organic matter.	Moisture.
		<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
1	Sandusky county.....	54.06	45.20	0.27	0.74	.....	.....
2	Wood county.....	53.93	43.25	.43	1.53	.....	.....
3	Seneca county.....	54.30	45.14	.16	.23	.....	.....
4	Marble Head, Ottawa county.....	53.20	15.83	.....	.15	0.02	0.80
5	Marble Cliff, Franklin county.....	51.14	16.00	1.08	1.94	.....	.....
6	.....do.....	53.28	2.69	2.13	1.41	.....	.....
7	Kellys Island, Erie county.....	97.28	2.00	.27	.85	.....	.....
8	.....do.....	59.16	9.40	.25	1.05	.....	.....
9	.....do.....	57.35	10.68	.20	1.49	.....	.....
10	Athens county.....	56.38	11.00	.32	2.10	.....	.....
11	Fremont, Sandusky county.....	40.01	58.91	.50	.41	.....	.....
12	Portage, Wood county.....	55.92	38.21	1.92	3.92	.....	.....
13	Genoa.....	54.20	44.60	.79	.15	.....	.....
14	Fostoria.....	55.41	42.99	.65	.21	.....	.....
15	Put-in-Bay, Ottawa county.....	58.23	33.52	.49	1.60	.....	.....
16	Springfield, Clarke county.....	50.91	41.09	1.39	5.50	.....	.....

The analyses of Nos. 1, 2, 3, 4, and 10 were made by Prof. Edward Orton, State geologist, Columbus, Ohio.

*Analyses of limestone from Findlay, Hancock county, Ohio.*

	<i>Per cent.</i>	<i>Per cent.</i>
Carbonate of lime.....	50.298	49.221
Carbonate of magnesia.....	42.000	37.837
Oxide of iron.....	2.021	4.101
Alumina.....	3.100	5.002
Silica.....	2.291	2.341
Sulphuric acid.....	Undetermined	1.285
<b>Total</b> .....	99.710	99.787



## OREGON.

In 1889 Oregon produced granite, limestone, and sandstone.

*Granite.*—The counties producing granite are as follows: Columbia, Multnomah, Clackamas and Jackson. By far the most important is the first-named county, the product of which went entirely into paving blocks. Small quantities were used for building, cemetery purposes, and bridge work.

*Limestone.*—Forty-one thousand dollars is the value of both limestone and lime produced in Baker county, in the northwestern part of the State. It was used entirely for burning into lime and for flux.

*Sandstone.*—Sandstone was produced in Linn and Jackson counties in small amount. According to the tests which have been made, the sandstone appears to do very well as a cupola lining.

*New and prospective developments.*—Mr. L. M. Perkins, of Hudson, opened a new sandstone quarry in the summer of 1890.

*Marble.*—Extensive deposits of marble near Roseburg, Douglas county, have been opened by Messrs. Woodard & Willis, of that city. The product is said to resemble the famous Tennessee marble, and includes all colors. Future developments will have to determine the value of this discovery. The Variety Marble Company, of Roseburg, has put in machinery for the purpose of developing marble quarries in Douglas county.

## PENNSYLVANIA.

Among all the States producing stone, Pennsylvania takes first place when all of the kinds of stone are considered, yielding a product valued at \$7,319,199. The total value of the entire stone product of the United States in 1889 was \$53,035,620. By comparing these figures, it will be noted that of the entire product Pennsylvania yielded 13.8 per cent. Its preëminence as a stone-producing State is due to the large amount of limestone and slate produced. In both of these kinds of stone Pennsylvania holds first place, and second place in the production of sandstone and bluestone. All of the various kinds of stone which are commercially distinguished from each other are produced in Pennsylvania. These kinds are, in the order of their relative importance for the State: Limestone, \$2,655,477; slate, \$2,011,726; sandstone, \$1,609,159; granite, \$623,252; bluestone, \$377,735, and marble, \$41,850.

*Granite.*—The total value of the granite output in 1889 was \$623,252. This product came from sixty-four quarries contained in the following counties: Delaware, \$122,279; Philadelphia, \$108,736; Montgomery, \$91,214; Bucks, \$90,884; Chester, \$66,398, and smaller amounts from Lancaster, Luzerne, Adams, Berks, Dauphin, Lehigh and York. Of the total output that devoted to street work is the most important, the value for this purpose being \$292,114. For general building purposes an amount valued at \$143,231 was used, and smaller amounts for bridge purposes. A little was used for cemetery work.



*New and prospective developments.*—Messrs. W. G. Cunningham & Co., of Philadelphia, opened a new granite quarry in Adams county in September, 1890.

*Sandstone.*—The total value of the sandstone produced in 1889 was \$1,609,159. The product came from the following-named counties, the most productive of which are in the northwestern, western, and southwestern parts of the States. The productive counties, in the order of their importance, are as follows: Beaver, \$344,038; Dauphin, \$243,219; Lawrence, \$130,973; Allegheny, \$120,315; Westmoreland, \$108,518; Montgomery, \$87,994; Lackawanna, \$72,260; Fayette, \$68,602; Luzerne, \$54,054; Somerset, \$51,717; and smaller amounts from Huntingdon, Bucks, Chester, Tioga, Philadelphia, Lancaster, Indiana, Berks, Blair, Lehigh, Erie, Lebanon, Clearfield, Lycoming, Venango, Jefferson, Cambria, Warren, Elk, Crawford, Armstrong, Clarion, McKean, Delaware, Greene and Susquehanna. Scattered over these are 159 quarries. Most of the product was used for building purposes, the amount devoted to this use being valued at \$777,123; for bridge work an amount valued at \$496,902 was used; for street work, \$175,062; to miscellaneous uses a smaller amount was devoted.

The following is an analysis made by Prof. Brenneman, of Ithaca, New York, of a sandstone from Luzerne county:

*Analysis of sandstone from Luzerne county, Pennsylvania.*

	Per cent.
Silica and insoluble matter.....	94.00
Ferric oxide.....	1.98
Lime.....	1.10
Magnesia.....	1.00
Volatile matter at red heat (water and carbonic acid).....	1.92
Alumina.....	Trace.
Total.....	100.00

The specific gravity of this stone is 2.656.

Further tests made of this stone show it to be of fine quality, eminently fitted for street work.

*Analysis of sandstone from McKee's Gap, Blair county, Pennsylvania.*

	Per cent.
Silica.....	99.10
Iron and alumina.....	.60
Magnesia.....	Trace.
Loss on ignition.....	.25
Total.....	99.95



Below are given two analyses of sandstone from Fayette county. The quarry from which this stone was taken is operated by Messrs. W. C. & H. S. Drumm, of Layton's Station.

*Analyses of sandstone from Fayette county, Pennsylvania.*

	No. 1.	No. 2.
	<i>Per cent.</i>	<i>Per cent.</i>
Silica .....	96.54	99.46
Alumina .....	3.39	.45
Iron .....	.01	Trace.
Water .....	.06	.09
Total .....	100.00	100.00

No. 1 from Layton quarry.  
No. 2 from Oakdale quarry.

*New and prospective developments.*—Sandstone quarries were opened in 1890 by the following firms: Messrs. Jute, Stratton & Foley, of Pittsburg, opened a sandstone quarry at Layton's Station. The Bellevue Land Company, of Washington, commenced operations upon a sandstone quarry; Mr. William E. Cunningham, of Pennsylvania, opened a brownstone quarry in Bucks county in December of 1890; Messrs. Robinson Brothers, of Homewood, Beaver county, began quarrying sandstone in August, 1890. The Middletown and Hummelstown Stone and Lime Company, of Middletown, began quarrying brownstone in the summer of 1890; Messrs. F. T. Scott's Sons, of York, opened a brownstone quarry in July, 1890; Messrs. Foster Brothers, of Allegheny, began quarrying brownstone at Homewood, Beaver county, in April, 1890.

*Bluestone.*—Bluestone is the name given to a variety of sandstone, which consists of grains or granules of silica cemented together by silica. This stone is used almost entirely for street work in the form of curbstones and flagging. It is quarried chiefly in New York State, although the product from Pennsylvania is scarcely to be distinguished from the New York stone, and enters into competition with it in the market. The total value of bluestone produced in Pennsylvania in 1889 was \$377,735. It came from seventy-two quarries reported in the following counties: Susquehanna, \$144,619; Pike, \$126,250; Wyoming, \$74,004; Bradford, \$16,476; and much smaller amounts in Monroe, Wayne, Lackawanna, Schuylkill and Lycoming counties.

*Limestone.*—The total value of the limestone produced in Pennsylvania in 1889 was \$2,655,477. Of the product, however, comparatively little was used as limestone itself, most of it being used for burning into lime and as blast-furnace flux. The productive counties, in order of their importance, are as follows: Montgomery, \$475,572; Lawrence, \$434,935; Chester, \$321,680; Lebanon, \$203,986; Lancaster, \$184,962; Northampton, \$171,674; York, \$135,575; Berks, \$129,651; Blair, \$122,665; Lehigh, \$85,559; Columbia, \$66,738; and smaller amounts in Huntingdon, Adams, Dauphin, Mifflin, Cumberland, Bedford, Lycoming, Franklin, Montour, Allegheny, Union, Bucks, Armstrong,



Northumberland, Somerset, Butler, Bradford, Beaver, Erie, Monroe, Crawford and Washington. For building purposes an amount valued at \$238,431 was used. The value of the lime produced, a large portion of which went for agricultural purposes, was \$1,195,955. For blast-furnace flux the value of the product consumed was \$949,083. The remainder was used for street and bridge work chiefly. It is probable that the amount named above as consumed for flux is smaller than the true amount. This is due to the fact that considerable quantities of limestone are quarried by blast-furnace establishments for fluxing purposes, of which, apparently, a careful account is not in all cases kept.

The following are analyses of the so-called Acme Avondale limestone of Chester county. The analyses were made by Messrs. Booth, Garrett and Blair, of Philadelphia:

*Analyses of Acme limestone from Chester county, Pennsylvania.*

	Dark colored stone.	Light colored stone.
	<i>Per cent.</i>	<i>Per cent.</i>
Carbonate of lime.....	73.07	94.82
Carbonate of magnesia.....	5.58	1.10
Oxide of iron and alumina.....	1.27	.13
Insoluble matter.....	20.87	4.34
Total.....	100.79	100.39

This stone shows a tendency to become popular as building stone, and its qualities generally render it desirable.

The following are analyses of stone from Hyndman, Bedford county, Pennsylvania, made by Mr. Otto Wirth, of Pittsburg:

*Analyses of limestone from Hyndman, Bedford county, Pennsylvania.*

	Blue stone.	Fossil stone.
	<i>Per cent.</i>	<i>Per cent.</i>
Insoluble matter.....	4.14	2.70
Carbonate of lime.....	95.76	97.30
Total.....	99.90	100.00

The following is an analysis of a limestone from a quarry in Armstrong county:

*Analysis of Armstrong county, Pennsylvania, limestone.*

	<i>Per cent.</i>
Carbonate of lime.....	96.007
Carbonate of magnesia.....	1.498
Oxide of iron and alumina.....	1.462
Phosphorus.....	.034
Silica.....	.790
Total.....	99.791



The following is an analysis of limestone from Midvale, Franklin county, by Prof. William P. Tourey, of Baltimore, Maryland:

*Analysis of limestone from Midvale, Pennsylvania.*

	Per cent.
Carbonate of lime .....	94.427
Carbonate of magnesia .....	3.880
Silica .....	1.700
Total .....	100.007

The following is an analysis of Franklin county limestone:

*Analysis of limestone from Franklin county, Pennsylvania.*

	Per cent.
Calcium carbonate .....	92.079
Magnesium carbonate .....	4.420
Iron .....	1.429
Silica .....	2.130
Total .....	100.049

The following are analyses of limestone from Fayette county:

*Analyses of Fayette county, Pennsylvania, limestone.*

	Per cent.	Per cent.	Per cent.
Calcium carbonate .....	95.210	95.180	94.460
Magnesium carbonate .....	3.400	1.840	3.520
Phosphorus .....	.005	.004	.005
Insoluble matter .....	1.385	2.976	1.980
Total .....	100.000	100.000	99.965

The following is an analysis of limestone from Columbia county:

*Analysis of Columbia county, Pennsylvania, limestone.*

	Per cent.
Carbonate of lime .....	90.47
Silica .....	6.08
Oxide of iron and alumina .....	1.36
Carbonaceous matter and water .....	1.50
Carbonate of magnesia .....	.59
Total .....	100.00

The following are analyses of limestone from Lime Ridge, Columbia county, Pennsylvania, by Messrs. Booth, Garrett, and Blair, of Philadelphia:



*Analyses of limestone from Lime Ridge, Columbia county, Pennsylvania.*

No.	Carbonate of lime.	Carbonate of mag- nesia.	Oxide of iron and alumina.	Phos- phorus.	Siliceous matter.
	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>	<i>Per cent.</i>
1.....	88.450	4.782	.660	.020	6.26
2.....	82.371	7.791	1.190	.023	8.83
3.....	70.981	5.630	3.444	.032	19.51
4.....	92.314	3.901	.530	.006	3.24
5.....	96.125	1.767	.500	.006	1.86
6.....	94.267	1.934	.550	.020	3.48
7.....	93.378	2.004	.630	.014	4.17

The following is an analysis of gray limestone from a quarry in Lawrence county, made by Mr. Otto Wirth, of Pittsburg:

*Analysis of gray limestone from Lawrence county, Pennsylvania.*

	<i>Per cent.</i>
Carbonate of lime.....	95.25
Carbonate of magnesia.....	1.63
Oxide of iron.....	.91
Alumina.....	.74
Silica.....	2.03
Phosphoric acid.....	.04
Sulphuric acid.....	Trace.
Total.....	100.00

The following is an analysis of East Conshohocken stone, Conshohocken, Montgomery county:

*Analysis of East Conshohocken limestone, Montgomery county, Pennsylvania.*

	<i>Per cent.</i>
Lime.....	51.600
Magnesia.....	8.300
Alumina.....	10.000
Oxide of iron.....	3.600
Silica.....	26.200
Phosphorus.....	.040
Sulphuric acid.....	.400
Total.....	100.140

The following is an analysis of limestone from Lawrence county:

*Analysis of Lawrence county, Pennsylvania, limestone.*

	<i>Per cent.</i>
Carbonate of lime.....	95.070
Carbonate of magnesia.....	.750
Silica.....	2.240
Phosphoric acid.....	.052
Oxide of iron and alumina.....	1.620
Organic matter.....	.150
Manganese.....	.100
Total.....	99.982
Phosphorus.....	.023



The following is an analysis of limestone from Hellertown, Northampton county:

*Analysis of limestone from Hellertown, Northampton county, Pennsylvania.*

	Per cent.
Carbonate of lime .....	53.875
Carbonate of magnesia .....	25.494
Sesquioxide of iron .....	4.060
Alumina .....	6.090
Silica .....	5.470
Phosphoric acid .....	.089
Sulphuric acid .....	.174
Manganese .....	1.016
Water and organic matter .....	3.640
Total .....	99.908

*New and prospective developments.*—Mr. Joseph Gassert, of Lebanon, began quarrying limestone for burning into lime in February, 1890. Limestone quarries were also opened during 1890 by Mr. J. B. K. Richenbach, of Leesport, Berks county, and William E. Laut, of Lancaster, Lancaster county.

*Slate.*—The slate industry of this State, everything considered, is perhaps the most interesting subdivision of its stone industry. The slate industry is in by far the greater part limited to Pennsylvania and Vermont. The total value of all slate produced in the United States in 1889 was \$3,482,513. The value of all slate produced in Pennsylvania in the same year was \$2,011,726. The total value of all slate produced in the State of Vermont was \$842,013. The importance of Pennsylvania as a slate-producing State is evident from these comparisons. While there is a great variety in the colors of the slate produced in Vermont, a similar statement does not apply to Pennsylvania, the product of which is entirely black, although a very fine distinction is locally made between black and a sort of bluish-black.

The actively quarried slate belt of Pennsylvania really begins in Sussex county, in the northeastern part of New Jersey, where, at La Fayette and Newton, there are slate quarries in operation, and also in Warren county, at Polkville. The Pennsylvania portion of this slate belt begins at the Delaware Water Gap, in the northeastern part of Northampton county, and extends through Northampton, Lehigh and Berks counties in a southwesterly direction. There is then a break filled up by Lebanon and Lancaster counties to the southwest, but in the southern part of York county operations in what is known as the Peach Bottom region reappear. Passing from the Delaware Water Gap in a southwesterly direction, the most important producing localities are as follows: Slateford, Mount Bethel, East Bangor, Pen Argyl, Wind Gap, Belfast, Edelman, Chapman Quarries, Treichlers, Danielsville, Walnutport, Slatington, Tripoli, Lynnport, Steinsville, and finally, in York county, a portion of what is known as the Peach Bottom region, which is for the most part in the northern part of



Harford county, Maryland. The most important localities in York county are West Bangor and Delta, which may be regarded as the principal points for the entire Peach Bottom region. The slate of Pennsylvania is frequently divided, more for commercial reasons than anything else, into the following regions: The Bangor region, the Lehigh, the Northampton Hard Vein, the Pen Argyl, and the Peach Bottom regions. The Bangor region is entirely within Northampton county, and is the most important. It includes quarries at Bangor, East Bangor, Mount Bethel, and Slateford; the Lehigh region includes Lehigh county entire, also a few quarries in Berks and Carbon counties, and also a small number of quarries in Northampton county on the side of the Lehigh river opposite Slatington; the Pen Argyl region embraces quarries at Pen Argyl and Wind Gap, in Northampton county. The Northampton Hard Vein region is especially distinguished on account of the extreme hardness of the slate as compared with that produced in other regions of the State. It includes the following localities: Chapman Quarries, Belfast, Edelman, Seemsville, and Treichlers, all in Northampton county. The Peach Bottom region includes four quarries in York county, Pennsylvania, and five in Harford county, Maryland.

One of the chief difficulties met with in quarrying the so-called "soft" slate of Pennsylvania is the occurrence of what are known as "ribbons." These ribbons are composed of foreign material and are exceedingly hard and interfere not a little with the smooth and economical quarrying of the slate. These ribbons are entirely wanting in the Peach Bottom slate, and this makes a great difference in the ease of quarrying in favor of the product of the Peach Bottom region. The slate produced at Chapman quarries and other localities quarrying the same kind of slate that is produced at this locality is so extremely hard that although it can be split with about the same readiness as the soft slate, it has to be sawed with diamond saws. This hardness is naturally an advantage to the slate, rendering it durable and nonabsorptive. For flagging purposes it is extremely adapted, chiefly on account of its hardness. The most important product into which this hard vein slate is made is roofing slate, although it finds considerable application for billiard tables, imposing stones, blackboards, cisterns, lintels, window sills, copings, ridgepoles, stairsteps, and floor tiles. For paving purposes it has given great satisfaction. For use in blackboards and school slates it does not appear to compare favorably with the output of Bangor and Lehigh.

Considering the slate product according to the counties, the following statement will suffice: Northampton, \$1,467,653; Lehigh, \$487,133; York, \$36,558, and very much smaller amounts from Berks and Carbon counties. There are in all 104 quarries. The value of all the slate produced for roofing purposes in 1889 was \$1,636,945; for other purposes the value amounted to \$374,831. It appears to be generally acknowledged that for the sum total of desirable qualities for roofing, the Peach



Bottom slate is far ahead of that from any other locality in Pennsylvania. The advantages are its unchangeable color, and the smooth and glassy appearance which it presents upon the roof, together with great durability.

The production of slate according to the various regions which have been enumerated for Pennsylvania is as follows: The Bangor region, \$707,162; Lehigh, \$690,382; Northampton Hard Vein region, \$184,595; Pen Argyl, \$393,030; Peach Bottom, including, however, that produced in Maryland, \$146,565.

The largest quarry in the State, and probably in the country, is the old Bangor quarry at Bangor. The dimensions of this quarry are 1,100 feet long, 350 feet wide, with an average depth of 175 feet. Operations are conducted on a very large scale here in every respect, two locomotive engines and a large number of cars being kept during a part of the year almost constantly employed in stripping and transporting the surface material to the dump.

Slate quarrying, not only in Pennsylvania but in all other States producing slate, is carried on almost entirely by the Welsh, in so far as skilled labor is concerned. This is of course due to the fact that operations of quarrying slate have been better studied in the enormous slate quarries of Wales than in any other part of the world, and naturally labor skilled in slate-quarrying comes from that country. For ordinary labor, such as stripping, Italians supply most of the demand. A large school-slate factory is in active operation at Bangor. In this factory the operations are carried on almost entirely by machinery, which is so perfect in its working that the manual labor required in attending to it is largely monopolized by children of both sexes. Similar statements may be made of large and prosperous school-slate factories in operation in Slatington and Walnutport. In the manufacture of roofing slate, boys are quite freely employed in the work of trimming the slates after they have been split to the proper thickness and approximate size. This practice enables the Welsh to keep the skilled work largely in their own hands, as they bring up their sons to learn the business after them, beginning with the light work of trimming, and as they grow older and stronger extending their work to the heavier operations.

Slate is well adapted for ornamental purposes after it has gone through the process of marbling. Quite a variety of stones and wood are thus imitated in a very successful manner. The following is a list of different kinds of stone which are thus imitated: Gray granite, Mexican onyx, fossil limestone, Devonshire marble, Tennessee marble, Circassian, Egyptian, and Pyrenees marble, and in fact all the better known varieties of variegated marble; also blue agate, red granite, red serpentine, the various kinds of woods, and petrified wood of California. As the industry progresses the number of different kinds of imitations increases. The slab to be marbled is first rubbed by hand with fine sand, using a wooden block covered with cloth. The marbling proc-



ess is done in two ways. For the marble having fine veins and lines running through it, like Spanish marbles, it is colored on a float, as it is called; that is to say, a large vat of water is sprinkled with the different oil paints required. The effect desired on the stone is thus produced on the surface of the water and is then transferred to the slab by simply immersing the slab and leaving the representation on it. According to the other method the coloring is done by hand, using brushes, sponges, and feathers to smear on the paint. In this process water colors are used. At this stage the slab is baked over night, the temperature of the oven or kiln varying from 175° F. to 225° F. After this first baking it is varnished, and the baking repeated. Next, it is scoured with ground pumice dust, varnished, and baked again. If any gilding is to be done, this is effected after coming out of the kiln for the third time. The next stage consists in rubbing with very fine pumice stone and a felt block, after which it is baked for the last time. Rubbing with rotten stone follows, and the final polish is put on by rubbing with the palm of the hand.

The purposes to which slate are applied are increasing quite rapidly from year to year. For quite a complete list of the uses to which slate is at present put, see the report on Vermont.

*New and prospective developments.*—Mr. George W. Geiser, of Easton, expected to develop slate property during 1890. Messrs. Jackson Brothers, of Pen Argyl, began operations upon a new slate quarry in the spring of 1890. The Doster Slate Company, of Bethlehem, organized late in 1889, began operations as slate producers in 1890.

*Marble.*—Marble was quarried in Montgomery county, at quarries near Conshohocken and King of Prussia. The total amount produced was valued at \$41,850. It was used largely for building purposes, chiefly for steps, window sills, exterior trimmings of houses, etc. The waste is used as flux in iron furnaces and also in the manufacture of glass. The quarries have been operated for a number of years.

#### RHODE ISLAND.

Granite, sandstone, and limestone were produced in Rhode Island in 1889.

*Granite.*—The value of the granite output was \$931,216. Rhode Island stands first among the granite-producing States in the value of granite devoted to monuments and general cemetery and decorative work. The productive counties are as follows: Washington, \$737,456; Providence, \$184,655, and smaller amounts from Newport and Kent counties. The value of the granite sold as cemetery and monumental stock was \$588,199; for general building purposes \$266,400 worth was used; for street work, including \$45,817 as the value of paving blocks, an amount valued at \$65,817 was used. The remainder was devoted to bridge, dam, and railroad work. The granite quarries and works located at Westerly, Washington county, have long been celebrated for the very fine orna-



mental stock produced. Most elaborately ornamented monuments and statues are turned out in great number. The plants for finishing and polishing are exceedingly well equipped, all the latest improvements in quarry tools being freely used. The stone is particularly well adapted for successful ornamentation and fine finish, and this accounts largely for the prominence of this branch of the granite industry in the State. In fine carving a pneumatic tool, striking exceedingly rapid blows and operated by heavy air pressure is becoming popular among granite-cutters. The rapidity with which fine work can be executed is very much increased by the use of this tool. Its value in connection with granite as well as with ornamental marble has already been satisfactorily demonstrated.

*Sandstone.*—Sandstone valued at \$21,170 was produced in Providence county. The product was used entirely for building.

*Limestone.*—Providence county also yielded limestone and lime together valued at \$27,625. Practically the whole amount was used for burning into lime, a very small quantity being used for flux.

#### SOUTH CAROLINA.

Granite and limestone were produced in this State in 1889.

*Granite.*—Nine quarries contained in Fairfield and Richland counties produced granite valued at \$47,614. Nearly the entire product came from the first-named county. It was used mainly for street work, the remainder being divided up between building, cemetery, and bridge work.

*New and prospective developments.*—New granite quarries were opened during 1890 by the following: Mr. A. J. Gilbert, in the neighborhood of Bordeaux, Abbeville county; the Columbia Granite Construction and Manufacturing Company, of Columbia; and Mr. F. Hopperfield, of Yorkville, York county.

*Limestone.*—Limestone valued at \$14,520 was produced in Abbeville and Spartanburg counties. It was used for bridge work and burning into lime.

*Marble.*—In 1889 Mr. O. E. Mayhew, of Columbia, discovered a bed of blue marble near Walhalla, Oconee county, and was taking steps to organize a stock company with a capital of \$25,000 with the purpose of developing it.

#### SOUTH DAKOTA.

The kinds of stone produced in this State are granite, sandstone, and limestone.

*Granite.*—The granite product in 1889 was valued at \$304,673. The entire amount came from Minnehaha county, in the southeastern part of the State. The product was divided in its application between paving blocks, valued at \$170,695, and building, which consumed the re-



mainder. Much of the stone classified here, for commercial reasons, as granite is really quartzite, a variety of sandstone.

*Sandstone.*—The production of sandstone in 1889 amounted to \$93,570. It was produced at twelve quarries located in the following counties, the most important of which is the first-named: Fall River, Lawrence, Pennington and Custer. Of the total value, \$81,941 worth was devoted to building purposes and the remainder to abrasive purposes. The above-mentioned counties are all in the southwestern part of the State. The following data were secured by Maj. John R. McGinnis, of the Ordnance Department, Rock Island Arsenal, Illinois. The stone was from Fall River county:

*Tests of South Dakota sandstone.*

Percentage of water absorbed .....	8.08
Specific gravity .....	2.47
Crushing strength, pounds per square inch .....	3,850

*Another specimen gave:*

Percentage of water absorbed .....	7.45
Crushing strength, pounds per square inch .....	5,200

*New and prospective developments.*—New sandstone quarries were opened in 1890 by the following companies: The Fall River Stone Company and the Norfolk Stone Company, at Hot Springs; Mr. Henry C. Ashe, of Sturgis county; and Messrs. Scott & Holmes, of Fairburn, in the southern Black Hills region of Custer county.

*Limestone.*—A very small quantity of limestone was produced in Custer county in the southwestern part of the State in 1889.

# T E N N E S S E E .

The stone interests of this State center chiefly in the marble production of Knox, Loudon, and Hawkins counties. In addition to the production of marble, however, comparatively small quantities of limestone and sandstone were also produced during the year 1889.

*Sandstone.*—A small quantity of sandstone, valued at \$2,722, was produced at four localities, situated in Giles, Marion, Campbell and Maury counties. It was almost entirely used for ordinary building purposes.

*Limestone.*—Limestone, valued at \$73,028, was produced in 1889 from the following counties: Houston, \$47,950; Davidson, \$9,120, and smaller amounts from Maury, Montgomery, Hickman, Franklin and Marshall counties. Most of the product was used for conversion into lime, the lime produced being valued at \$60,625. The remainder was divided up between the ordinary building, flux, and street work.

*Marble.*—The total value of the marble output of Tennessee in 1889 was \$419,467. This product came from twenty-two quarries in Knox, Hawkins and Loudon counties. Of the total value, a product valued at \$283,154 was produced in Knox county. The value of that from



Hawkins county was \$103,813. The remainder, \$32,500, came from Loudon county.

The marble-producing region of Tennessee is in the extreme eastern and northeastern parts of the State. Tennessee marble first came into notice about 1863, following immediately upon the close of the war. The first notable use to be made of it was in the United States Capitol building at Washington. Ever since the discovery of the product it has been valued chiefly for purposes of interior decoration and for use in furniture. The product from Hawkins county is the handsomest and brings a much higher price than the product from either Knox or Loudon county. The principal shipping point for the Hawkins county product is Whitesburg. The most important cities in the country for the manufacture of marble into furniture tops are Cincinnati, Ohio, and Baltimore, Maryland. The marble product of Tennessee is so generally well known for its attractive qualities that it is scarcely necessary to enter upon the subject further here. Judging from efforts which were being made to secure further investment of capital and to improve transportation facilities, greater strides will be made in the next few years in the marble regions of Tennessee than have been known heretofore. The consolidation of some six or seven previously independent firms into what is known as the Tennessee Producers' Marble Company will doubtless have the effect of stimulating the industry and preserving a definite grade of prices. The demand for the stone, particularly for interior decoration in dwellings as well as in public buildings, seems to be all that could be desired, and probably the condition of trade would stand a much more active development of the quarries than has heretofore been effected. Improvements in transportation facilities are sadly needed.

*New and prospective developments.*—The Awalt Marble Company, of Tullahoma, has been organized as a branch of the Tennessee Land and Improvement Company. It expects to commence the development of marble deposits in the vicinity of Tullahoma, Coffee county. Marble similar to Hawkins county marble has been discovered at Fountain City, a suburb of Knoxville, Knox county. It is expected that the Fountain City Land Company, which owns the property, will organize a company to develop the stone. The Athenian Marble Company has been incorporated for the purpose of developing marble quarries near Athens, McMinn county. Marble has been discovered recently in Marion county, a few miles from South Pittsburg. The product has been analyzed, and is pronounced of good quality, susceptible of high finish and of beautiful color.

*Slate.*—Although as yet no slate has been quarried in Tennessee, it is probable that this State will shortly become productive of this stone. The Tennessee Slate Company has been organized to quarry slate at a point between Chilhowee mountain and McGregor's Knob. The slate is regarded as of fine quality and suitable for roofing, as well as most of the other purposes to which slate is applied.



## TEXAS.

Granite, sandstone, and limestone were produced in Texas in 1889. The stone industry of this State dates back for only a few years, no mention whatever being made of the production of stone in Texas in the Tenth Census report.

*Granite.*—Eight quarries in Burnet, Gillespie and Llano counties, all in the central part of the State, produced granite valued at \$22,550. Almost the entire output was used for ordinary building, a very small quantity being devoted to cemetery purposes. The locality in Burnet county at which the granite for the new capitol was quarried is Marble Falls. The quarrying operations involved in obtaining stone for the capitol were largely conducted with convict labor. The amount of granite at this point is inexhaustible and appears to be of good quality. The presence of an enormous water power is an inducement for more extended quarrying operations than have yet been attempted. The adoption of this stone for the new capitol is the best guaranty of its merit. It shows considerable variety in color, ranging from red or rose color—the stone of which the capitol was constructed—to a light gray, with various intermediate shades. It has shown a resistance to a pressure of 11,891 pounds to the square inch before crushing. At or near Marble Falls marble said to be of fine quality is found in large quantities. It has shown a crushing strength of 14,782 pounds to the square inch, the tests having been made by Col. D. W. Flagler at Rock Island, Illinois. It is said that quarrying operations could be conducted at small cost, as there is but little stripping to be done. One of the largest dams in the world is now in course of construction across the Colorado river just above the city of Austin. The principal stone used in the work is granite from the quarry near Marble Falls. The Houston and Texas railroad has secured control of the Austin and Northwestern railroad, running from Austin to Burnet and Marble Falls, has changed the gauge from narrow to standard, and gives a direct outlet from the quarry to the seaboard and to other railway transportation. This granite is also used to considerable extent for the jetty work at Galveston. Sandstone is also found at the same locality.

*Sandstone.*—The value of the sandstone produced in 1889 in Texas was \$14,651. It was taken from seven quarries contained in the following counties named in order of relative outputs: Washington, Parker, Grimes, Llano, Brown, Collin and Wise. It was entirely used for building.

*Limestone.*—Limestone, valued at \$217,835, including the value of lime made from a portion of it, was obtained from eighteen quarries contained in the following counties, named in order of their importance: Travis, \$62,686; Hood, \$50,000; Bell, \$35,698; Grayson, \$23,040; El Paso, \$19,138, and smaller amounts from Washington, Lamar, Fannin, Lampasas, Coryell and Dallas. The product to the value of \$135,901 was used for building. The value of the lime produced was \$6,700. The remainder was used for flux, street, and bridge work.



The following is an analysis of limestone from El Paso county.

*Analysis of limestone from El Paso county, Texas.*

	Per cent.
Carbonate of calcium.....	97.50
Silica and trace of iron.....	2.50
Total.....	100.00

#### UTAH.

Sandstone valued at \$48,306, limestone at \$27,568, and granite at \$8,700 were quarried in 1889.

*Sandstone.*—The sandstone output came from Utah, Summit, Emery, and Box Elder counties, nearly the entire amount coming from the first two named. The entire product was used for building in Salt Lake City, Provo City, and Ogden.

*New and prospective developments.*—Mr. H. W. Lawrence, of Salt Lake City, opened a sandstone quarry in February, 1891.

*Limestone.*—Limestone came from Salt Lake and San Pete counties, by far the greater part, however, from Salt Lake county. It was used mainly for burning into lime and for fluxing.

*Granite.*—A very small quantity of granite was produced in Salt Lake and Weber counties. The amount was small and was used mainly for building, although a little was devoted to cemetery work.

*Marble.*—The marble interests would apparently well repay more extended investigation than has been thus far devoted to them. There are marble beds south of Nephi which are said to be of good quality, although it has not yet been proved that they are capable of yielding large blocks free from flaws. Another deposit is the property of the Wasatch Marble Company on the divide between the heads of the Big Cottonwood and Snake creeks. The marble here covers many acres and is said to be hundreds of feet in thickness. It is white in color and free from cracks or stains. It is said that blocks could be taken out as large as it would be possible for the heaviest machinery to handle. Efforts are now being made to develop this property.

*Slate.*—Mr. F. W. C. Hathenbruck, of Provo City, commenced quarrying slate and serpentine during the summer of 1890.

#### VERMONT.

This State occupies a unique position in the United States in regard to the stone industry. This is due to the fact that it is the great marble-producing State of the Union, producing vastly more than all the rest of the country put together, and, secondly, to the fact that it is only second to Pennsylvania in the production of slate. The kinds of stone produced are granite, sandstone, limestone, marble, and slate.



*Granite.*—The total value of the granite produced in 1889 in this State was \$581,870. The product came from 53 quarries in the following counties: By far the most important granite-producing county is Washington, the output of which was valued at \$474,341; second is Windham county, with a product valued at \$52,460. The remaining are: Orange, \$24,100; Caledonia, \$18,027; and smaller amounts from Chittenden, Orleans and Windsor counties. The most important developments of the last decade in this State are those which have been made at Barre. At this point there is an enormous supply of granite of the finest quality, such that the product is well adapted, not only to all the ordinary uses to which granite is put, but also for the finest kinds of monumental and decorative work, to which it is quite largely applied. The methods of quarrying are modern. In one of the quarries in this locality the Knox system of blasting is in very successful use. The application of this recent method of blasting granite is quite limited, and is not received with favor by a great many of the large producers of granite in this and other States. The objections to the system as applied to granite are probably, however, due more to the results of single, and in some cases, unsuccessful experiments than to long continued and fair trials of it. The amounts devoted to the various purposes to which granite is applied are: Cemetery and ornamental work, \$412,287; ordinary building, \$45,198; street work, \$48,323; bridge work and miscellaneous uses, \$76,062.

*New and prospective developments.*—The following firms have opened granite quarries during the year 1890: The Green Mountain Granite Company, at Barre; the Excelsior Granite Company, at Montpelier; Mr. Jacob B. Taylor, at Barre; and the Berlin Granite Company, at West Berlin.

*Sandstone.*—A very small quantity of sandstone for abrasive purposes was produced in Orleans county.

*Limestone.*—The total value of limestone and lime produced in 1889 was \$195,066. Of this amount \$168,808 was the value of the lime produced. For building purposes an amount valued at \$5,010 was produced. The remainder was divided up between street and bridge work.

*Marble.*—As already stated, the marble output of Vermont amounts to more than is produced in all other localities in the United States. The total value of the marble product in 1889 was \$2,169,560. This came from but three counties in the State: Rutland, \$1,844,301; Bennington, \$229,059; Franklin, \$96,200. From this it is evident that the Rutland quarries produce nearly the entire output. The productive counties are all in the western part of the State, and, interrupted only by Chittenden county, extend from the Dorset quarry in the southwestern corner to the Champlain marbles at Swanton in the extreme northern part. The quarries now operated are in or near the towns of Manchester, Dorset, East Dorset, Wallingford, Rutland, West Rutland, Proctor, Pittsford, Brandon, Fair Haven, Middlebury, North



Ferrisburg and Swanton. Abandoned quarries are found all along the railroad from Dorset to Middlebury. The largest operators in the State are to be found at West Rutland and Proctor. At these places quarrying operations are carried on on an enormous scale with the very latest and most improved machinery, and taken all together they are the finest examples of economically quarried property to be found in the world. The abundant water power at Proctor is fully utilized in the operations of the large mills owned by the Vermont Marble Company. Power is transmitted largely through the medium of compressed air.

*New and prospective developments.*—The Taconic Marble Company was formed for the purpose of developing marble property in Bennington in the summer of 1890. Two quarries are now in working order and a considerable output may be looked for in 1891.

*Slate.*—The total value of the slate output in 1889 was \$842,013. This product comes entirely from Rutland county. The area in which slate is actually produced at present is confined to a narrow strip in Washington county, New York, and a somewhat wider one lying next to it in Rutland county, Vermont. It extends from Castleton, Vermont, on the north, to Salem, New York, on the south, a distance of 35 or 40 miles, and has a maximum width of 6 miles, but the average is not more than a mile and a half. Scattered over this territory there are about forty-nine quarries in Vermont, and abandoned quarries or those which for one cause or another are at present idle number many more. The first commercial use to be made of the slate of this region was between thirty and forty years ago, when Messrs. Alanson and Ira Allen began on a small scale the manufacture of school slates from the stone obtained at Scotch Hills, 2 miles north of the village of Fair Haven. This quarry is still in operation. The industry has now reached large proportions, the number of quarries keeping pace with the demand for the stone, and this is steadily increasing as new purposes are found for its application. Besides its well-known adaptability for roofing, slate is used locally in a comparatively rough state for sidewalks, curbstones, hitching posts, underpinning, cellar walls, and door steps. As a manufactured article, after going through the mill, it is offered for the following purposes: Billiard-table beds, mantels, fireboards, register frames, radiator tops, steps and risers, platforms, tiles, wainscoting, moldings, thresholds, window sills, lintels, brackets, laundry tubs, washbowl tops, cisterns, sinks, urinals, refrigerators, blackboards, mangers, curriers' slabs, imposing stones, grave boxes, grave covers, headstones, grave markers, vault doors, water tables, belting courses, counter tops, brewers' vats, greenhouse shelves, chimney tops, switch boards, and panels for electric work. In the marbleizing process it is susceptible of considerable ornamentation, which makes it more desirable still for many of the above uses and also extends the list of its uses as follows: Table tops, stand tops, card-receivers, soda-water fountains, checker boards, doorplates, signs, and paper weights.



The slate differs somewhat in its physical properties, such as hardness, homogeneity, and cleavage, but the greatest variation is to be found in its color, no other place in the world showing as many colors in an area of equal size. Most of the commercial names under which the slate is sold are descriptive of the color of each kind and are as follows: Sea green, unfading green, uniform green, bright green, red, bright red, cherry red, purple, purple variegated, variegated and mottled.

The line dividing Vermont and New York also marks the division of two important varieties of slate. The true sea green is found only in the former State, while the red is entirely confined to the latter, some of the quarries producing the respective kinds being, however, but a few hundred yards apart. The sea-green slate is manufactured almost entirely into roofing slates, more than three times as many squares being made from it as from all other varieties combined. It is quarried very extensively in the villages of Pawlet and Poultney. The selling price per square is lower than for any other prominent kind quarried in the region, and the greater output results both from its predominance in the localities mentioned and from the ease with which it is worked, the split being remarkably pronounced. When first quarried its color is a pleasant grayish-green, but after being exposed to the weather it gradually fades and changes in a very unequal manner, certain sheets turning brown, others light gray, while some remain practically unchanged. A roof covered with it presents, after a year or two, a peculiar spotted appearance. It is, however, a good wearing slate and the objection to its color is the principal one against it.

As already stated, no red slate is produced in Vermont, while the red-slate quarries of New York, just across the dividing line, are the only ones in the world producing red slate.

*New and prospective developments.*—A movement was on foot in the latter part of 1890 to purchase all the sea-green slate quarries in Vermont. The syndicate is said to be backed by English capital and its ultimate object is to obtain control of the entire sea-green slate product of the world.

#### VIRGINIA.

The stone resources of this State are as yet comparatively undeveloped. The great drawbacks to progress in the stone industry have been lack of capital and facilities for transportation. Production at a not distant day in the future will probably far exceed anything that has yet been accomplished in any one year. The kinds of stone at present actually produced are granite, sandstone, limestone, slate, and marble.

*Granite.*—In 1889 thirteen quarries, scattered over six different counties, produced granite valued at \$332,548. These counties and the value of stone produced in 1889 are as follows: Chesterfield, \$135,916; Amherst, \$59,125; Henrico, \$55,507; Alexandria, \$40,000;



Campbell, \$27,000, and Dinwiddie, \$15,000. The product was more largely used for building purposes than any other, the amount devoted to this purpose being valued at \$120,467; \$79,925 worth went for street work and the remainder was used chiefly for bridge and railroad work. A number of the quarries in the vicinity of Richmond have been operated successfully for quite a number of years. The plants are comparatively well equipped, and, while operations might be conducted upon a considerably larger scale, they may be said to be prosperous. The stone from most of these quarries is of good quality and is generally well received.

*New and prospective developments.*—The Rocky Mount Granite Company has recently purchased quarries near Rocky Mount, Franklin county, and apparently their intention is to materially increase operations at these quarries, which have previously been carried on by other parties. The Roanoke Granite Company, of not less than \$35,000 capital, has recently been incorporated for the purpose of developing granite quarries in the State.

*Sandstone.*—The sandstone output of 1889 came from Campbell and Prince William counties and was valued at \$11,500. It was entirely used for building purposes.

*New and prospective developments.*—A new sandstone quarry in the vicinity of Manassas, Prince William county, was commenced in 1890.

*Limestone.*—Eleven quarries in nine counties of the State produced limestone and lime together valued at \$159,023. The productive counties are, in order of importance, Botetourt, \$46,000; Alleghany, \$45,646; Shenandoah, \$27,295, and smaller amounts in Roanoke, Montgomery, Warren, Pulaski, Loudoun and Washington. The larger part of this product comes from quarries in the southwestern part of the State. The value of lime produced was \$83,667. For fluxing, principally in blast furnaces, \$48,146 worth was used. A small quantity was used for street and road purposes.

*Slate.*—The Virginia slate product comes entirely from Bingham county. The product in 1889 was valued at \$113,079. The product enters the market in competition with that from the important regions of Pennsylvania and Vermont, and is well adapted for roofing and many of the other purposes to which slate is applied. Amherst county will doubtless produce slate before long. The Mount Ayre Slate Company is at present engaged in the development of a slate quarry near Scottsville, Albemarle county.

*Marble.*—The only marble produced in Virginia in 1889 was taken from a quarry in Mountsville, Loudoun county, by the Virginia Marble Company. Although considerable merchantable stone has been quarried, practically none has been sold, as it has been found impracticable to transport the product by wagons over the roads which connect the quarries with Leesburg, the nearest point on the railroad. There are prospects that a branch road connecting with the Chesapeake and



Ohio railroad may be built to the quarries, but until this is done the product can not be considered as on the market. For the purpose of interior decoration and furniture tops, the stone is undoubtedly very fine.

*New and prospective developments.*—Experts have examined the marble property in the neighborhood of Staunton. According to indications thus far, it is likely that quarrying operations will be undertaken. Mr. J. S. Smith has just organized a stock company, with a capital of \$100,000, to develop marble property near Fincastle, Botetourt County, and the preliminary operations of stripping have already begun.

#### WASHINGTON.

Limestone, sandstone and granite were produced in this State in 1889. The value of the limestone was \$231,287. The bulk of the entire product comes from San Juan county, in the northwestern part of the State. Very small quantities were produced in Kitsap and Douglas counties. Practically nearly the whole product is used for burning into lime, small quantities being devoted to building and blast-furnace flux.

*Sandstone.*—The sandstone output was valued at \$75,936. It is used entirely for building and comes from the following counties, named in order of their importance: Whatcom, \$42,000; Thurston, \$18,000; and Pierce, \$15,936. According to investigations made by experts sent out by the Cleveland Stone Company, of Cleveland, Ohio, very fine sandstone in inexhaustible quantities has been revealed on the shores of Lake Whatcom.

*Granite.*—A small quantity of granite—\$10,000 worth—was produced in Stevens county, in the northeastern part of the State. It was entirely used for building purposes. Mr. O. D. Guilfoil has recently opened a quarry of black granite in King county. Small shipments have been made.

#### WEST VIRGINIA.

Sandstone, valued at \$140,687, and limestone, at \$93,856, were produced in this State in 1889.

*Sandstone.*—The sandstone comes from the following counties, named in the order of their outputs: Kanawha \$66,000; Wood, \$18,839; Summers, \$18,800; Ohio, \$15,150; and smaller amounts from Marion, Lewis, Preston, Ritchie, Harrison, McDowell and Taylor. Most of the product was used for bridge, dam, and railroad work; \$40,000 worth was used for building, and a smaller amount for street work. A large proportion of it was used in the city of Charleston, situated in Kanawha county.

*Limestone.*—The limestone comes mainly from Berkeley county, with a production of \$61,000; \$21,411 from Jefferson, and the remainder from Greenbrier. The total value of the product was \$93,856. These counties are in the northeastern and southeastern parts of the State. The great bulk of the stone was used for burning into lime. Smaller amounts



were used for flux, building, and railroad work. There are but eight operative quarries in the State. The value of the lime produced was \$82,471.

There are large quantities of sandstone and limestone in West Virginia which have not yet been at all developed. There seems to be a decided need of increased capital and better railroad facilities. Near Martinsburg, in the northeastern part of the State, are the most important limestone quarries. At this place patent kilns are in use and a good quality of lime is produced. The Alderson brown stone quarries in Summers county yield a valuable stone, which is easily quarried and well adapted to building purposes and also for street work.

#### WISCONSIN.

Sixty quarries producing limestone and sandstone were operated in 1880. A total output valued at \$227,065 was produced. In 1889, a total of 119 quarries produced granite, sandstone, and limestone, the entire output of stone being valued at \$1,264,016. These comparisons speak for themselves in showing the great strides in the stone industry which have been made in the last decade in this State.

*Granite.*—The granite production of the State has been entirely confined to the past decade, no mention of granite in this State having been made in the Tenth Census report. The value of the granite in 1889 was \$266,095 and represented the output from eight quarries scattered over Green Lake, Marinette, and Marquette counties. The product was distributed as follows: Green Lake, \$154,645; Marinette, \$79,950, and Marquette, \$31,500. The great bulk of the product was used for street work in the manufacture of paving blocks. The total value of granite devoted to street work is \$223,825. Of this amount \$179,075 was the value of the paving blocks produced; \$40,640 worth was used for building purposes and a comparatively very small amount for cemetery work. The marked advances made in the production of granite are emphatically shown by the statement that this State stands in sixth place among the granite-producing States of the Union in the value of paving blocks produced. Most of the paving blocks came from Green Lake and Marquette counties, for which Milwaukee forms an important place of consumption.

*Sandstone.*—Thirty-two quarries, scattered over fourteen counties in the State, produced sandstone in 1889. The productive counties, in the order of importance, are as follows: Bayfield, \$69,995; Pierce, \$28,980; Douglas, \$28,096; Ashland, \$28,000; Dunn, \$15,261, and smaller amounts from Sauk, Lafayette, Monroe, Portage, Jackson, Lacrosse, Trempealeau, Dane and Grant. Bayfield, Douglas and Ashland counties, in the northwestern extremity of the State, produced together \$126,091 worth of stone. The remainder comes from the central, western, and southwestern parts of the State. Nearly the



entire product was used for building purposes, a small amount being devoted to bridge and railroad work.

*Limestone.*—Seventy-nine quarries produced \$813,963 worth of limestone and lime. The productive counties are as follows: Fond du Lac, \$160,800; Calumet, \$133,842; Milwaukee, \$99,550; Waukesha, \$98,020; Racine, \$57,017; Ozaukee, \$53,640; Dodge, \$35,844; Manitowoc, \$31,370; Winnebago, \$27,120; Brown, \$25,669; Washington, \$25,358; Door, \$20,254, and smaller amounts from Saint Croix, Lacrosse, Sheboygan, Rock, Walworth, Buffalo, Trempealeau, Outagamie, Jefferson, Portage, Dane, Grant, Iowa, Columbia, and Green. The first twelve counties produced \$768,484 worth of the entire output. They are all in the southeastern part of the State, and Milwaukee is the most important outlet. Of the total value of limestone and lime \$514,947 is the value of the lime produced. For building purposes an amount valued at \$232,780 was used. Smaller amounts were devoted to street, bridge, and railroad work; and also for blast-furnace flux. The following analyses have been made:

*Analysis of limestone from Calumet county, Wisconsin.*

	Per cent.
Calcium carbonate .....	55.50
Magnesium carbonate .....	38.20
Alumina .....	2.27
Oxide of iron .....	.67
Silica .....	3.14
Total .....	99.78

*Analysis of limestone from Winnebago county, Wisconsin.*

[By Dr. John C. Jack.]

	Per cent.
Calcium carbonate .....	51.97
Magnesium carbonate .....	42.91
Iron .....	.18
Alumina .....	1.82
Silica .....	3.01
Total .....	99.89

*Analysis of limestone from Brillion, Calumet county, Wisconsin.*

	Per cent.
Carbonate of calcium .....	55.09
Carbonate of magnesium .....	43.96
Alumina .....	.36
Silica .....	.59
Total .....	100.00

This stone is used almost entirely for burning into lime, which appears to be very popular throughout the territory in which it is used.



## WYOMING.

*Sandstone.*—Sandstone to the value of \$16,760 was produced in the following counties, in the order of value: Laramie, Albany, Converse, Carbon and Sweetwater. The product was entirely used for building, and chiefly in Cheyenne.

*Limestone.*—In Laramie county a trifling amount of limestone was produced.

*Marble.*—A marble quarry has been discovered in Converse county. No output has yet been secured, but, according to the evidence so far, the stone is of a fair quality and efforts have been made to secure the investment of capital in the deposit, but as yet without success. The locality is seven miles from the nearest railroad.